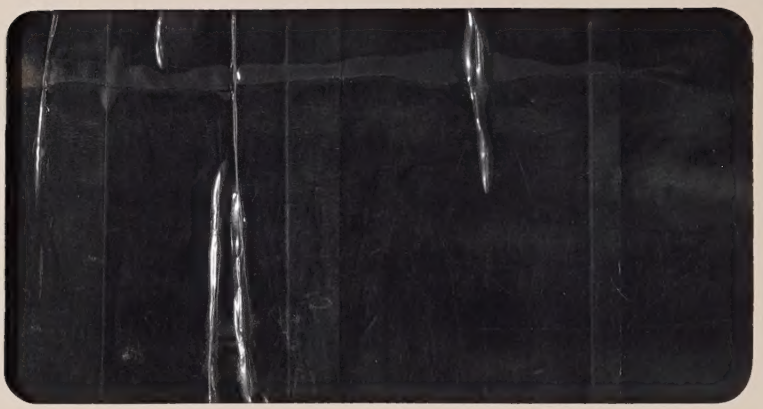
M304X SERIES
LINE PRINTER
CE MANUAL

FUJITSU



M304X SERIES
LINE PRINTER
CE MANUAL

FUJITSU LIMITED
Communications and Electronics
Marunouchi, Tokyo, Japan

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REVISION RECORD		
Edition	**Date published**	**Revised contents**
	Aug., 1984	Advance Release
01	Sep , 1984	
Specification No.: B02P-1500-0017A		

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This manual is a reference for customer engineers in charge of maintenance for M304x series line printers. This manual contains information on the M3040, M3041, and M3042. For the M3043, refer to a separate volume.

This manual consists of the following six chapters:

Chapter 1	General Description Describes specifications and general configuration.
Chapter 2	Installation Instructions Describes information necessary for installation.
Chapter 3	Operation Instructions Describes how to operate these line printers and also simple troubleshooting.
Chapter 4	Theory of Operation Describes the configuration and operation.
Chapter 5	Maintenance Analysis Procedure (MAP) Describes troubleshooting.
Chapter 6	Repair, Replacement, and Adjustment (REP) Describes how to repair, replace, and adjust malfunctioning parts.

This manual also has appendixes containing information about expendable supplies for these printers and interfaces with the system (mainframe).

Using this manual, the reader can operate and maintain M304x series line printers.

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CHAPTER 1
GENERAL DESCRIPTION

1.1 Introduction

The M304x series is our latest series of impact line printers using a print band. It consists of the M3040, M3041, M3042, and M3043. This manual contains information on the M3040, M3041, and M3042. For the M3043, refer to a separate volume. The printing speeds of the M3040, M3041, and M3042 are 390, 750, and 1090 lpm for 48-character sets and 300, 600, and 900 lpm for 64-character sets. Figure 1.1 shows the M304x series line printer (excepting M3043).

Figure 1.1 M304x series line printer (excepting M3043)

1.2 Specifications

This section describes specifications of the M304x series line printers and ribbons. For forms specifications, see Appendix A.

1.2.1 Printer specifications

Table 1.1 lists the printer specifications. For electrical specifications and ambient conditions, see Section 1.3.

Table 1.1 Printer specifications

Item		M3040	M3041	M3042
Print band	Type	48-, 64-, and 96-character sets (others optionally available)		
	Replacement	By operator		
Printing method		Continuously rotating print band struck by rotary hammers		
Printing speed	48-character set	390 lpm	750 lpm	1090 lpm
	64-character set	300 lpm	600 lpm	900 lpm
	96-character set	210 lpm	420 lpm	670 lpm
Print positions		132 or 136 print positions per line (Selectable)		
Character spacing		2.54 mm (10 print positions per inch)		
Character set	48-character set	10 numerics, 26 upper-case alphabetics, and 12 symbols		
	64-character set	10 numerics, 26 upper-case alphabetics, and 27 symbols		
	96-character set	10 numerics, 26 upper-case and 26 lower-case alphabetics, and 32 symbols		
Font type		Standard Gothic (others optionally available)		
Character code		ASCII (others optionally available)		
Number	Carbonless copy paper	6 (Including original)		
	Forms with interleaved carbon paper	5 (Including original)		
Sound pressure level		55 dB A (In the ECMA condition)		

Table 1.1 - continued

Item		M3040	M3041	M3042
Forms feed rate	Line spacing time	18 ms		
	Continuous feed	424.2 mm/s (16.7 inches/s)		
Vertical line spacing		4.23 or 3.18 mm (6 or 8 lines/inch)		
Format control tape (FCT) option		8- or 12-channel FCT is available.		
Interface		DPC, Centronix, RS-232C, and other available options		
Dimensions (W x H x D)		700 mm (27.56") x 1095 mm (43.11") x 900 mm (35.43")		
Weight		180 kg (397 lbs)		

1.2.2 Ribbon specifications

This printer uses an endless cartridge type or open-type ribbon, which only moves in one direction. The ribbon is replaced by the operator. The ribbon specifications are as follows:

Table 1.2 Ribbon specifications

Item	Specification
Fabric	Nylon
Width	30 mm (1.18 inch)
Length	100 m (109 yards)
Ink	Black record medium
Storage life	2 years

1.3 Installation Conditions

This section shows the outer dimensions, operation and maintenance area, electrical specifications, and environmental conditions of the printer.

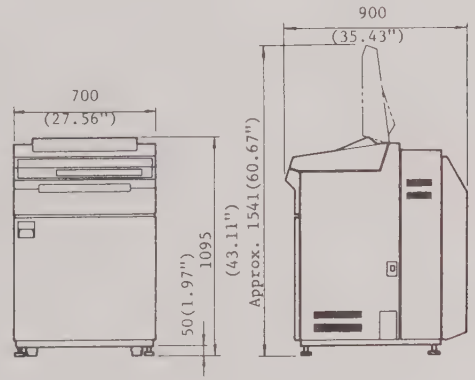


Figure 1.2 Outer dimensions

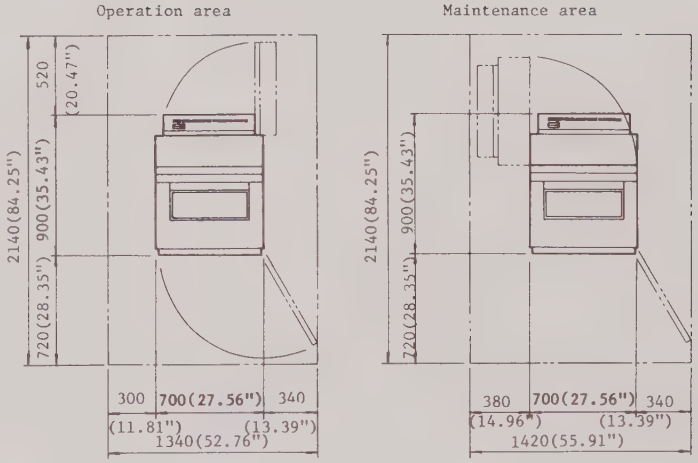


Figure 1.3 Operation and maintenance area

Table 1.3 Electrical specifications

Item \ Model			M3040	M3041	M3042
Primary voltage			100/110/115/120/200/220/230/240 V AC ±10%		
Phase			Single phase		
Frequency			50 or 60 Hz $^{+2}_{-4}$%		
Power consumption	When printing	48-character set 136-column printing	550 VA	700 VA	850 VA
		64-character set 136-column printing	520 VA	630 VA	760 VA
	When not printing		250 VA		
Starting surge			50 A or less		

Table 1.4 Environmental conditions

Item			Condition		
			M3040	M3041	M3042
Ambient conditions	When operating	Temperature range	5°C to 40°C (41° to 104°F)		
		Relative humidity	20% to 80% RH		
		Maximum wet-bulb temperature	29°C (84.2°F)		
	When not operating	Temperature range	-20°C to 50°C (-4° to 122°F)		
		Temperature gradient	15°C/h (27°F/h) or below		
		Relative humidity	10% to 90% RH (Without condensation)		
		Maximum wet-bulb temperature	29°C (84.2°F)		
Heat dissipation (64-character set 136-column printing)			360 kcal/h	440 kcal/h	530 kcal/h
Air flow			5 m^3/min		

1.4 Configuration

The printer consists of the mechanical unit, control unit, forms rack, and cabinet. The top cover and front door are included in the cabinet. The operator panel, control circuit board, and power supply are included in the control unit. Figure 1.4 shows their locations.

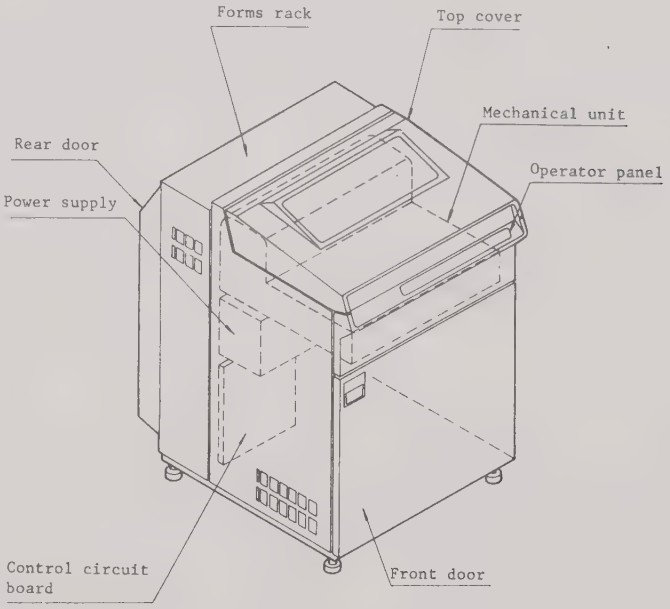


Figure 1.4 Printer configuration

1.4.1 Mechanical unit

The mechanical unit consists of the following:

- Base unit (includes the print-band drive section)
- Print unit
- Forms feed unit
- Ribbon unit

(1) Base unit

The base unit is fixed to the cabinet frame. A platen, a print-band drive motor, a pair of band pulleys, and a variable-reluctance transducer for detecting each type location are in the base unit.

The print-band drive section has a simplified structure for easy print-band replacement by the operator.

(2) Print unit

The print unit is attached to the base unit and consists of four hammer magnet assemblies and a print unit frame.

The print unit can slide horizontally to the base unit by using a lever on the base unit to make the forms path wider so that an operator can easily load forms.

The hammer magnet assemblies consist of magnet assemblies and hammer assemblies, with hammers for 36 print positions. To improve print quality, rotary-type hammers are employed. Hammer magnet coils are arranged with sufficient space around them to ensure hammer-unit compactness.

(3) Forms feed unit

The forms feed unit is fixed to the print unit frame. A pair of forms tractors with a lever for adjusting the horizontal forms position, forms tractor drive mechanism, and a stepper motor to drive the unit are in the forms feed unit. The ADVANCE FORMS knob for adjusting the vertical forms position and the SHIFT FORMS knob for adjusting horizontal forms position are also provided.

(4) Ribbon unit

The ribbon unit is fixed to the base unit. It consists of ribbon feed rollers, a ribbon feed motor, a ribbon feed sensor, ribbon guides, and a ribbon container.

1.4.2 Control unit

The control unit consists of the following (see Figure 1.5):

- Control circuit
- Operator panel
- Hammer magnet driver
- Power supply

(1) Control circuit

The control circuit is on one PC board and is installed in the maintenance section, which can be accessed by opening the forms rack at the rear of the printer.

The control circuit uses two microprocessors; one for interface control and the other for printer control.

The LSI for print control reduces the number of parts and improves reliability.

(2) Operator panel

The operator panel is located at the upper front of the printer. Control switches and indicator lamps on the operator panel are on a PC board.

(3) Hammer magnet driver

The hammer magnet driver for the 136 magnets is on one PC board. It is installed on the rear of the print unit and is connected directly to the magnet assembly on the PC board.

A simple circuit is achieved by using custom ICs and a transistor array, enabling easy detection of faulty columns.

(4) Power supply

The power supply consists of the power supply unit and a transformer.

The transformer is connected to an AC input through a line filter and a circuit breaker. Input voltages of 100 to 240 V can be selected by switching the appropriate tap on the transformer.

The power supply unit has regulation circuits for logic circuits and hammer magnet driving, a forms feed stepper motor drive circuit, and control relays for the AC motor.

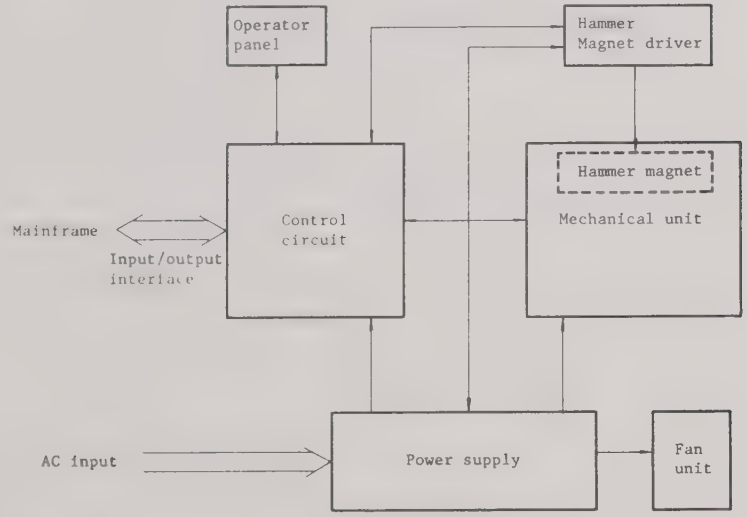


Figure 1.5 Control unit

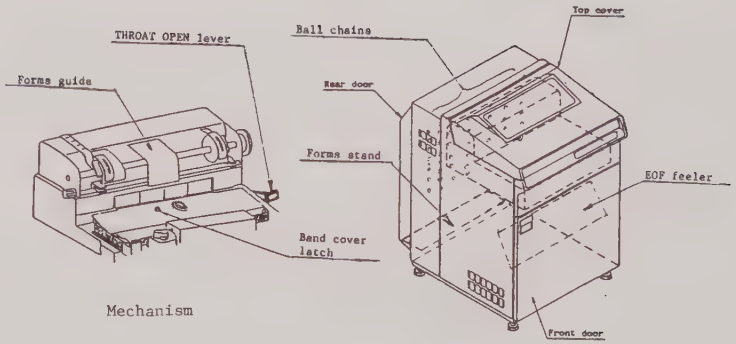
CHAPTER 2
INSTALLATION INSTRUCTIONS

This chapter explains installation, which must be performed in the following order: unpacking, inspection, cabling, initial power-on, and testing the printer.

When the Winchester-type interface connector is used, use a standard screwdriver to connect it.

2.1 Unpacking

① Remove the outer packing (crate).
② Remove the inner packing (polyethylene film and plastic sheet containing air bubbles) and also the desiccant on the bottom within the wrap.
③ Remove masking tape used to lock printer parts during transportation. The masking tape is applied at locations shown in Figure 2.1.



Mechanism

Figure 2.1 Masking tape locations

④ Remove the protective covers from the glass windows of the top cover and rear door and on the operator panel.
⑤ Level the printer by adjusting the leveling pads. To adjust the leveling pads, insert a screwdriver into a hole of the leveling pad. Turn it clockwise to lower it and counterclockwise to heighten it. See Figure 2.2.

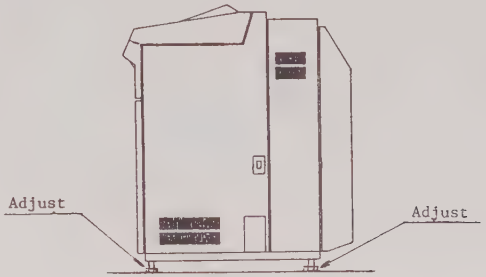


Figure 2.2 Adjusting leveling pads

2.2 Inspection

① Check the printer doors and covers for scratches or damage.
② Check the device number, production date, and serial number on the manufacturer's data plate (under the interface connector). This information is necessary when calling a customer engineer.
③ Check the accessories supplied, against the accessory list. The accessories for this printer are as follows:

Ribbon cartridge	1
Power cable	1
Test record	1
Print sample	1
Test forms (standard continuous forms)	Approx. 100 pages
Accessory list	1

④ Make sure that the input power voltage and frequency labels (near the power cable connector) agree with the power source.
⑤ Open the top cover and pull up the band cover latch to open the band cover, then remove the V-belt cover. See Figure 2.3.

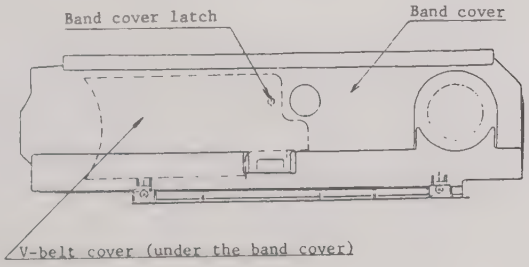


Figure 2.3 Band cover latch and V-belt cover

Make sure that the numbers stamped on the motor pulley are correct (Figure 2.4). These numbers indicate the model number and power frequency as follows:

M3040, M3041	1-50, 1-60
M3042	2-50, 2-60

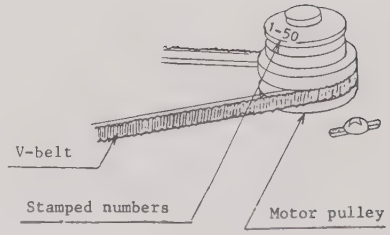


Figure 2.4 Numbers on the motor pulley

⑥ Make sure that the print band is installed on the drive and idler pulleys. (See Figure 2.5.) Also make sure that the printer mechanism has no abnormality.

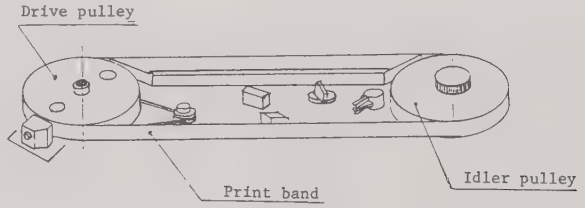


Figure 2.5 Print band on the drive and idler pulleys

⑦ Install the V-belt cover and close the band cover.
⑧ If the printer is not the one that was ordered or if it is damaged, call a customer engineer.

2.3 Cabling

After inspection, both the power and interface cables must be connected prior to initial power-on.

2.3.1 Power cable connection

Connect plugs at both ends of the power cable; the male connector to an AC receptacle and the female connector to the printer. See Figure 2.6.

2.3.2 Interface cable connection

Connect an interface cable plug to the printer. No tools are necessary for AMP-type interface connector connection. However, a standard screwdriver is necessary for Winchester-type interface connector connection. See Figure 2.6.

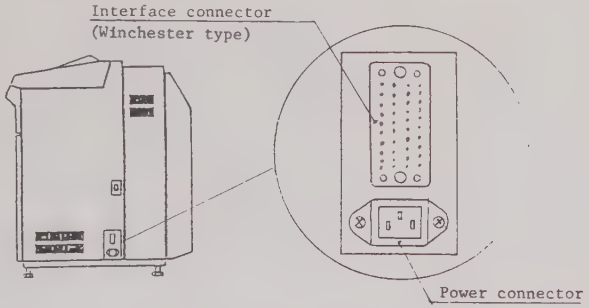


Figure 2.6 Power and interface connectors

2.4 Preparing for Initial Power-On

After the power and interface cables are connected, mount the forms and ribbon before initial power-on.

2.4.1 Mounting forms

See Figure 2.7.

① Lift the THROAT OPEN lever to unlock the print unit and to open the forms path A. This also pulls the EOF feeler upward.

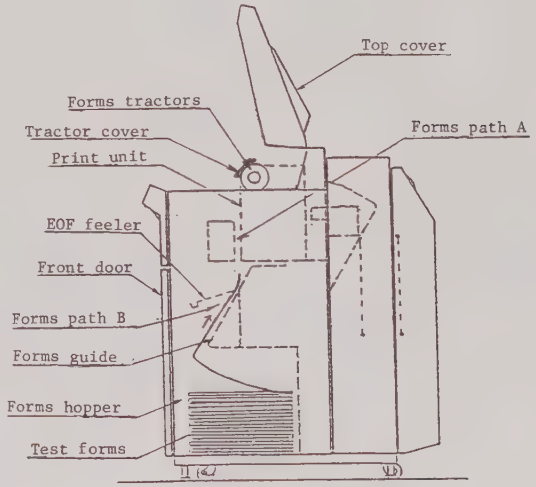


Figure 2.7 Forms mounting

② Open the front door.
③ Place the test forms in the forms hopper.
④ Insert the first page into forms path B (the slot between the EOF feeler and the forms guide) and push it upward.
⑤ Pull the first page out of the upper forms path A.

⑥ Open the tractor covers of the left and right forms tractors and mount the first page on them.
⑦ Close the tractor covers to hold the forms.

2.4.2 Mounting ribbon

See Figure 2.8.

① Pull the RIBBON DRIVE RELEASE lever toward you to disengage the ribbon feed rollers.
② Pull a short length of ribbon out from the ribbon exit (slit) of the ribbon cartridge and lead the pulled-out ribbon around the ribbon feed sensor roller. Then, push the ribbon cartridge down into the ribbon container.
③ Pull a short length of ribbon out from the ribbon entrance (wide opening) of the ribbon cartridge. Lead the pulled-out ribbon between the ribbon feed rollers and put it around the ribbon arm at the left. Lead it between the ribbon separator and the print band, then guide it around the ribbon guide in the right.
④ Push the RIBBON DRIVE RELEASE lever back to its original position.
⑤ Turn the ribbon feed rollers by hand to take up the ribbon slack.
⑥ Make sure that the ribbon is not slack or twisted.
⑦ Move the THROAT OPEN lever down to lock the print unit into place.
⑧ Close the top cover.

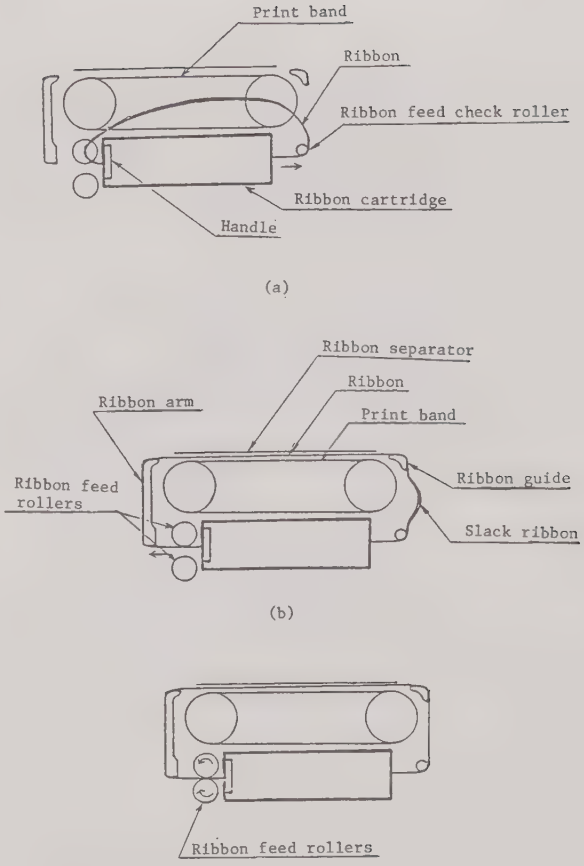


Figure 2.8 Ribbon mounting

2.5 Initial Power-On

① Set the MODE SELECTION switch to NORMAL.
② Set the power on/off switch on the lower right side of the printer to position 1 to turn on the printer. (See Figure 2.9.)

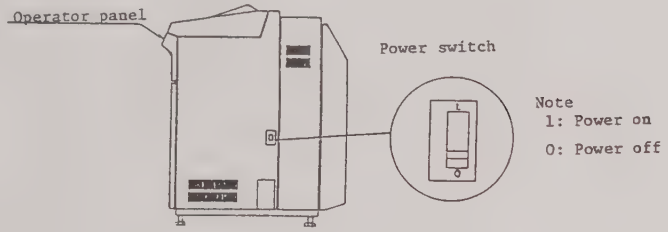


Figure 2.9 Power switch

③ Make sure that the power is turned on (the POWER lamp on the operator panel lights). The TOP OF FORM lamp will light and the STATUS indicator will display OFLINE on the operator panel.
④ If the POWER lamp does not light, check whether the power cable connectors are firmly connected to an AC receptacle and to the printer power connector and the distributor switches are turned on. If these are all right and the power cannot be turned on, call a customer engineer.
⑤ If the ERROR lamp on the operator panel lights, check whether the forms are correctly mounted, the top cover, the band cover, and the print unit are closed, and a format control tape (FCT) is loaded (if the optional FCT unit is installed). If these are all right or corrected, press the ERROR RESET switch and make sure that the ERROR lamp goes off. If the ERROR lamp still lights, call a customer engineer.

2.6 Testing the Printer

After initial power-on, test the printer functions offline and online. The forms position must be adjusted for printing prior to these tests.

2.6.1 Forms position adjustment

See Figure 2.10.

① Open the top cover.
② Align the top-of-form position (the first print line on a page) with the line scale on the left forms tractor, using the ADVANCE FORMS knob for rough adjustments. Figure 2.11 shows an example in which the line space is 6 LPI, the top-of-form position is the third line, and the page length is 11 inches.

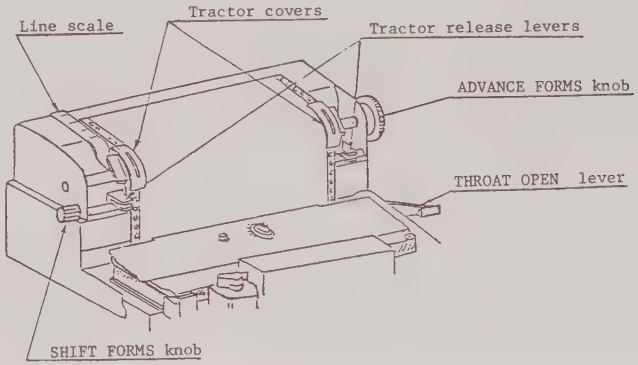


Figure 2.10 Forms adjustment knobs

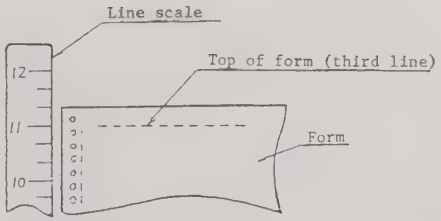


Figure 2.11 Example of forms alignment

③ Adjust the lateral tension of the forms using the tractor release levels. The forms require tension in the range where pin feed holes of the forms will not be damaged during printing.
④ Adjust the horizontal print position by using the SHIFT FORMS knob.
⑤ Adjust the forms position in the forms hopper to enable the forms to move straight into the printer.
⑥ Move the THROAT OPEN lever down to lock the print unit.
⑦ If necessary, adjust fine forms position using the FINE FORMS ADJUST switches on the operator panel. Then, pull the forms downward slightly to make them taut.
⑧ Close the front door.
⑨ Set the FORMS THICKNESS knob to an appropriate position according to the forms thickness. (Set to 1 for the test forms.)
⑩ Close the top cover.

2.6.2 Offline test

① Make sure OFLINE is shown in the STATUS indicator and set the MODE SELECTION switch to TEST. The TEST MODE lamp will come on and TEST will be displayed in the STATUS indicator.
② Press the FINE FORMS ADJUST (▲) switch for about 0.5 seconds. The STATUS indicator display will change from TEST to SFTPRT. If it is not SFTPRT, press the FINE FORMS ADJUST ▲ switch repeatedly until SFTPRT is displayed.
③ Press the START/STOP switch. The START/STOP lamp lights and the printer starts printing the shift pattern.
④ Make sure that the forms are fed to the forms rack and that the ribbon is fed normally. Check that the output is printed normally and that the print band is the one that was ordered.
⑤ Press the START/STOP switch to terminate the test. The START/STOP lamp goes out.
⑥ Set the MODE SELECTION switch to NORMAL. The TEST MODE lamp goes out and the STATUS indicator displays OFLINE.
⑦ If the ERROR lamp lights and the printer stops before the end of forms during the offline test, call a customer engineer.
⑧ If you want to change the setting of the printer, see Section 3.3.4.

2.6.3 Online test

First, set the printer online by pressing the START/STOP switch. The START/STOP lamp will light. In this online mode, carry out the online test by mainframe operations.

CHAPTER 3

OPERATION INSTRUCTIONS

This chapter explains the use of the operator panel and the adjustment of knobs and levers.

3.1 Operator Panel

This section explains the functions of the switches and lamps on the operator panel.

3.1.1 Outline

The operator panel is mounted at the right front of the printer (see Figure 3.1).

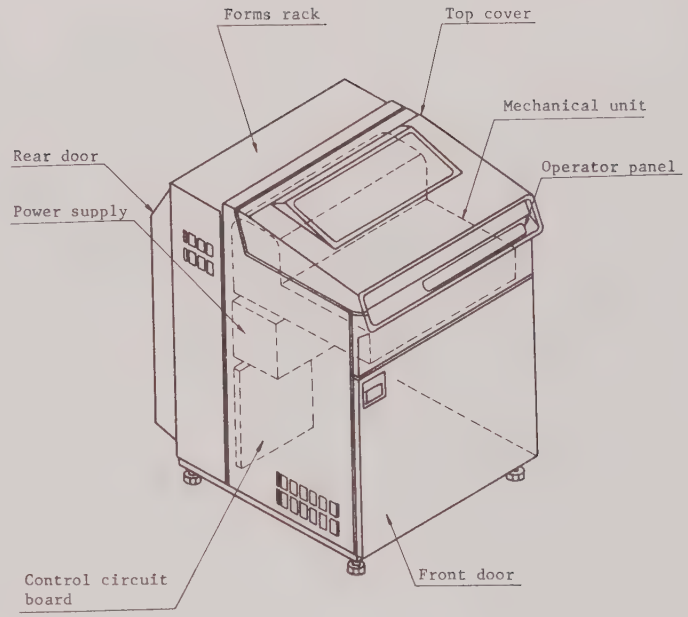
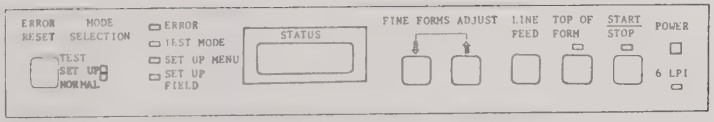


Figure 3.1 Printer

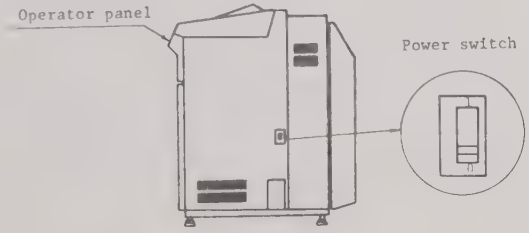
The operator panel consists of pushbutton switches, a slide switch, LED lamps, and a STATUS indicator. It controls the printer and indicates the printer status and print interruptions requiring the attention of the operator (see Figure 3.2).



: Pushbutton switch
: Slide switch
: LED lamp
: STATUS indicator

Figure 3.2 Operator panel

The printer power on/off switch is on the lower right side of the printer (see Figure 3.3).



Note: 1: Power on
0: Power off

Figure 3.3 Power switch

3.1.2 Switches and lamps

(1) MODE SELECTION switch

The MODE SELECTION switch is used to set one of the modes listed in Table 3.1.

Table 3.1 Printer modes

MODE SELECTION switch position	Mode	Printer operation
NORMAL	Normal mode	The printer operates online and prints data from the system. If an error is detected, the printer status and error contents are displayed or the STATUS indicator.
TEST	Test mode	The printer executes test printing or self-diagnosis. The printer does not operate online in this mode.
SET UP	Set up function mode	The printer selects a function and sets it up. The function does not change until another function is set. The function remains in effect even though the power is turned off.

(2) Other switches and lamps

The operator panel switch functions and display lamp meanings vary with the mode (see Table 3.2).

Table 3.2 Functions of operator panel switches and lamps

Switches and lamps		Normal mode	Test mode	Set up field mode
POWER	Lamp	Indicates that the printer power is on.		
6 LPI	Lamp	When the lamp is on, the forms feed pitch is 6 LPI (lines per inch). When the lamp is off, the forms feed pitch is 8 LPI (lines per inch).		
START/STOP	Switch	If this switch is pressed when the ERROR lamp is off, the lamp above this switch turns on and printer operation starts (online). When the ERROR Lamp is on, this switch is disabled. If this switch is pressed when the START/STOP lamp is on, printer operation stops (the printer goes offline). The lamp goes out as soon as printing is completed.	This switch starts and stops test execution.	(1) After the MODE SELECTION switch is set to SET UP, pressing this switch and the ERROR RESET switch sets the SET UP MODE and turns on the SET UP MENU lamp. (2) If this switch is pressed when the SET UP MENU lamp is on, the SET UP MENU indicated by the STATUS indicator is selected, the SET UP MENU lamp goes out, and the SET UP FIELD lamp comes on. (3) If this switch is pressed when the SET UP FIELD lamp is on, the FIELD indicated by the STATUS indicator is selected and the function is changed. (For further details, see Subsection 3.3.4.)
	Lamp	When the START/STOP lamp is on, the printer is in START status (online) and can receive data from the CPU. When this lamp is off, the printer is stopped (offline). If an error is detected when the printer is in start status, the ERROR lamp comes on and the START/STOP lamp goes out. At the same time, an error code is displayed on the STATUS indicator.	This lamp is always on during test execution.	This lamp is not on in this mode.
TOP OF FORM	Switch	If this switch is pressed when the START/STOP lamp is off, the print forms are fed to the top of form position. When the START/STOP lamp is on (the printer is online), this switch is disabled.		This switch is disabled in this mode.
	Lamp	The print forms are positioned at the top of form.		
LINE FEED	Switch	When the START/STOP lamp is off, pressing this switch feeds the print forms one line at a time. If the switch is held down, the forms continue to be fed one line at a time until the switch is released. When the START/STOP lamp is on (the printer is online), this switch is disabled.		This switch is disabled in this mode.

Table 3.2 - continued

Switches and lamps		Normal mode	Test mode	Set up field mode
FINE FORMS ADJUST	Switches	These two switches are enabled only when the printer is offline. They are disabled when the printer is online. (1) The switches are used to make fine vertical adjustments for positioning forms. Both switches are disabled when the error lamp is on. ▲: When this switch is held down, forms are slowly fed upward. ▼: When this switch is held down, the forms are slowly fed downward. When it is used, the forms must not have any slack. Open the THROAT OPEN lever and pull the forms tight. (2) When the error lamp is on, the switches operate as follows: ▲: Forms are not fed as explained in item (1). Instead, error codes are displayed when errors are detected. ▼: This switch is disabled.		The switches change and display the SET UP MENU and FIELD modes. (1) When the SET UP MENU lamp is on, pressing either switch displays menu items sequentially on the STATUS indicator. (2) When the SET UP FIELD lamp is on, pressing either switch displays field items sequentially on the STATUS indicator. (For further details, see Subsection 3.3.4.)
STATUS	Indicator	(1) When the ERROR lamp is off, the STATUS indicator shows the printer status (see Table 3.3). (2) When the ERROR lamp is on, the STATUS indicator shows the error that was detected (see Table 3.4).	(1) When the ERROR lamp is off, the STATUS indicator shows the current test mode or test (see Table 3.5). (2) When the ERROR lamp is on, the STATUS indicator shows the error that was detected during test execution (see Table 3.4)	(See Table 3.6.)
ERROR	Lamp	When this lamp is on, the STATUS indicator is displaying error information.		This lamp does not light in this mode.
TEST MODE	Lamp	This lamp does not light in this mode.	This lamp indicates TEST MODE.	This lamp does not light in this mode.
SET UP MENU	Lamp	This lamp does not light in this mode.		When this lamp is on, a function can be selected. After the MODE SELECTION switch is set to SET UP, this lamp lights when the START/STOP switch and the ERROR RESET switch are pressed.
SET UP FIELD	Lamp	This lamp does not come on in this mode.		When this lamp is on, the function selected from the SET UP MENU can be set.
ERROR RESET	Lamp	(1) When the ERROR lamp is off, this switch is disabled. (2) When the ERROR lamp has lighted, and the error has been corrected, press this switch to return the STATUS display to what it was before the error.		After the MODE SELECTION switch has been set to SET UP, pressing the START/STOP switch and this switch sets the SET UP mode. (For further details, see Subsection 3.3.4.)

Table 3.3 STATUS indicator display (1)

STATUS indicator display	Meaning
DIAG	The self-diagnosis program is being executed, or initial loading of the format control tape (FCT) when power is turned on is being executed.
COVER	The top cover is open. The ERROR lamp does not normally light when the top cover is opened. If the ERROR lamp is on with this status display, the error contents will be displayed when the top cover is closed. (See Table 3.4.)
INTRLK	The THROAT OPEN lever or BAND COVER latch is pulled upward. The ERROR lamp does not normally light when the THROAT OPEN lever or BAND COVER latch is pulled upward. If the ERROR lamp is on with this status display, the error contents will be displayed when the THROAT OPEN lever and BAND COVER latch are closed. (See Table 3.4.)
OFLINE	The printer is offline.
ONLINE	The printer is online.
TEST	The printer is set to TEST mode.
SET UP	The printer is set to SET UP mode.

3.2 Knobs and Levers

Figure 3.4 shows operating and adjustment knobs and levers.

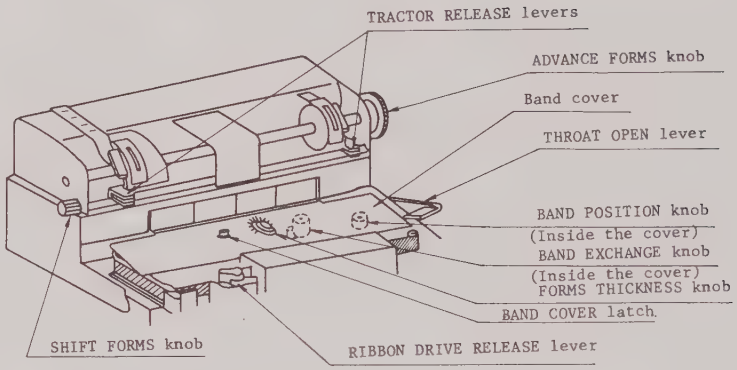


Figure 3.4 Operation knobs and levers

(1) THROAT OPEN lever

This lever is used when forms are being set or the ribbon changed.

When the lever is lifted, the print unit is unlocked and moved toward the rear to make the clearance between the print unit and base unit wider.

When the print unit is unlocked, the print band and ribbon stop, and INTRLK (interlock) is indicated on the operator panel.

The print unit is locked by repositioning the lever. When the print unit is locked, the interlock indication THROAT goes off.

(2) BAND POSITION knob

This knob adjusts the vertical position of the pulley. Turning this knob adjusts the print band position.

(3) FORMS THICKNESS knob

This knob is used for adjusting the print timing and print pressure to compensate for the thickness of the forms being used.

The knob is turned counterclockwise when the forms are thick and clockwise when the forms are thin, as illustrated on the band cover. This knob prevents the following kinds of faulty printing and forms damage:

- Missed characters
- Fading at tops or bottoms of characters
- Skewed copy paper
- Torn perforations

(4) BAND COVER latch

This latch holds the band cover, and is used when the print band is changed or cleaned.

When this latch is unlocked, the print band and the ribbon stop, and INTRLK is indicated on the operator panel.

(5) BAND EXCHANGE knob

This knob is used only when the print band is changed. It is located inside the band cover to prevent accidental turning.

(6) TRACTOR RELEASE levers

These levers are used to set the horizontal positions of the forms tractors to fit different width forms, or to adjust the forms lateral tension.

(7) ADVANCE FORMS knob

This knob is used to align the forms with the line scale. It is also used when the vertical print position is not aligned properly.

When the knob is turned clockwise, the forms move upward; when turned counterclockwise, the forms move downward. When the knob is turned counterclockwise, the forms become slack and must be pulled down from the bottom.

(8) SHIFT FORMS knob

This knob is used for fine horizontal adjustment of the forms.

When it is turned, the forms lateral position changes about ± 1 mm.

(9) RIBBON DRIVE RELEASE lever

This lever is used to change the ribbon.

When it is turned counterclockwise, the ribbon feed rollers are disengaged, so that the ribbon cannot be fed to the ribbon container. The ribbon check indication RIBBON is displayed on the operator panel when this lever is not reset and the printer goes online. This lever must be reset after the ribbon is changed. When the ERROR RESET switch is pressed, the indication RIBBON goes off.

3.3 Operation

This section explains selection of modes and the replacement and cleaning of parts.

3.3.1 Power On and Off

(1) To turn printer power on, set the power switch on the right side of the cabinet to position 1 (see Figure 3.3).
Make sure the POWER lamp on the operator panel lights.

(2) To turn power off, do the following:
a. Ensure that printing or forms feeding is not in progress, and that the printer is in stop mode.
b. Set the POWER switch to position 0. The POWER lamp will go off.

(3) If a power supply or cooling fan fault is detected, power will be turned off automatically.

Note: Do not set the power switch to position 0 during printing or forms feeding.

3.3.2 NORMAL mode

(1) Confirm that the forms are in place and the top cover closed.

(2) Set the MODE SELECTION switch to NORMAL and turn the POWER switch on. The POWER lamp lights and the printer automatically executes the self-diagnosis program.
a. If no faults occur, OFLINE is displayed on the STATUS indicator.
b. If any faults occur, the ERROR lamp lights and one of the error codes explained in Table 3.4 is displayed on the STATUS indicator.

(3) If there is an asterisk * in the notes column of the error explanation in Table 3.4, press one of the FINE FORMS ADJUST switches (▲ or ▼) to display the error contents.
If several faults occur, the contents of each error are displayed in sequence by repeatedly pressing either the ▲ or ▼ switch.

(4) After correcting all errors (see Table 3.4), press the ERROR RESET switch. The ERROR lamp goes out and OFLINE is displayed.

(5) In either (2) a or (4) above, confirm that OFLINE is displayed and press the START/STOP switch. When the START/STOP lamp lights, ONLINE should be displayed and the printer should come online.

(6) If an error occurs when the printer is online, the printer is automatically switched offline, the error lamp lights, and the error is displayed on the STATUS indicator (see Table 3.4).

(7) After correcting the error, press the ERROR RESET switch to turn the ERROR lamp off.

(8) Press the START/STOP switch to bring the printer online again. The START/STOP lamp should light and ONLINE should be displayed.

(9) When the printer is online, pressing the START/STOP switch puts the printer offline. The START/STOP lamp should go out and OFLINE should be displayed.

Table 3.4 STATUS indicator display (2) - Errors

STATUS indicator display	Meaning	Solution
DIAGER	A self-diagnosis error was detected when the POWER switch was turned on. Press the ▲ or ▼ switch to display the error contents. 40: Internal buffer (IBF) read/write error 41: Device control (DVC) response error 42: Error in device control (DVC) counter 43: Print data buffer (PDB) read/write error 44: Abnormal current in the print magnet 45: Faulty checkout signal from hammer magnet driver 46 xxx: Open coil check xxx is faulty column number.	When this error is detected, the printer is disabled. This error is not reset by pressing the ERROR RESET switch. Call a customer engineer.
COVER	The top cover is open.	Close the top cover completely. See Table 3.3.
INTRLK	The THROAT OPEN lever or BAND COVER latch is open or only partially locked.	Close the THROAT OPEN lever or BAND COVER latch completely. See Table 3.3.
FORM	End of forms was detected.	Set new forms. See Section 3.3.5
STACKR	The stacker is full. This message is output only if the optional power stacker is being used.	Empty the stacker. This error occurs only in a printer equipped with a power stacker.
JAM	Forms feeding is abnormal; forms have jammed or are torn.	The forms are out of position. Reset correctly. See Section 3.3.5.
RIBBON	Ribbon feeding is abnormal; the ribbon is jammed or torn.	Replace the ribbon. See Section 3.3.6.

Table 3.4 - continued

STATUS indicator display	Meaning	Solution
NOCHNL	Forms are not being fed because the channel specified by the SKIP command was not found in the FCB or FCT data.	Check the FCB or FCT data and make sure the correct channel was entered in the SKIP command.
PTYCHK	The parity of data received from the main frame was not correct.	Check whether the printer uses odd or even parity. If the parity used in the I/O interface differs from the one set, change the parity using the SET UP menu. If this error recurs, call a customer engineer.
IFSERR	The I/O interface logic (active high or low) set in the printer does not agree with the logic used by the mainframe system. This error remains in the printer set online until the I/O interface signal logic set in the printer is altered in the set-up mode.	Change the logic set in the set-up mode IFS HI or BCL HI menu.
FCTERR	There is an error in the FCT unit or paper tape in a printer equipped with the FCT option. When the error occurs, the printer goes to FLS mode. The details of this error are displayed as follows.	Check the details of the error by pressing the ↑ or ↓ switch.
	Display Meaning	
	12: FCT read error or punch error	Make the FCT unit read the FCT twice. If the data reads differently each time, check the FCT. Check the FCT page length.
	13: FCT too long. (The page length is more than 255 lines.)	Check the FCT page length.
	14: FCT too short. (The page length is one line.)	Call a customer engineer.
	15: FCT control error. (The FCT is not set in the FCT unit, an FCT jam occurred, or the FCT unit is faulty.)	Punch channel 1 in the FCT.
	16: Channel 1 non-detect. (Channel 1 is not punched in the FCT.)	

Table 3.4 - continued

STATUS indicator display	Meaning	Solution
LDERR	Errors were detected while FCB data was being loaded. The details of this error are displayed as follows.	Check the details of the error by pressing the ↑ or ↓ switch.
	Display Meaning	
	17: The FCB data is on one line.	Check the data loaded in the FCB. Correct the FCB data and reload it in the FCB.
	18: The FCB data exceeds 254 lines.	
	19: The odd data or STOP code of the FCB data is not correct.	
BAND	A print band fault was detected. The details of this error are displayed as follows.	Check the details of the error by pressing the ↑ or ↓ switch. Call a customer engineer.
	Display Meaning	
	20: The print band speed is abnormal.	Call a customer engineer.
	21: The print band was not activated, or PSE was not generated.	Check whether the print band is correctly set. If it is, call a customer engineer.
	22: HP was not detected.	Call a customer engineer.
	23: PSE was not detected.	Call a customer engineer.
	24: HP or PSE was not detected correctly.	Call a customer engineer.
	25: The code ROM for the optional print band is not set.	Call a customer engineer.
	26: The print band has started and has been identified, but its speed is abnormal.	Call a customer engineer.
SYNCH	Synchronization between the font and print data buffer is faulty.	Call a customer engineer

Table 3.4 - continued

STATUS indicator display	Meaning	Solution
HMRCHK	Print magnet abnormality. The error contents are displayed as follows: Display Meaning 36 xxx: The magnet of a column xxx is on when no printing is specified for it. 37 xxx: The magnet of column xxx is off when printing is specified for it. 38 : Current flow through the print magnet is abnormal.	Check the details of the error by pressing the ↑ or ↓ switch. Call a customer engineer. The faulty column number is indicated by xxx. Call a customer engineer. The faulty column number is indicated by xxx. Call a customer engineer. The faulty column number is indicated by xxx.
PTOERR	Indicates that one line was not printed out within the specified time.	Call a customer engineer.
ITLKER	Printing is crooked because the THROAT OPEN lever or BAND COVER latch is pulled upward.	Make sure that the THROAT OPEN lever or BAND COVER latch is correctly set. If the error recurs, call a customer engineer.
FUSE	A fuse has blown.	Call a customer engineer.
FAN	The fan is faulty or has stopped.	Call a customer engineer.

3.3.3 TEST mode

(1) With the printer off (the POWER lamp is out), set the MODE SELECTION switch to TEST and turn the POWER switch on.

This sets the printer to TEST mode. The POWER lamp should light and TEST should be displayed on the STATUS indicator.

(2) If TEST mode is required when the printer is online in NORMAL mode, follow one of the three procedures below.

a. If the START/STOP lamp is on, press the START/STOP switch to put the printer offline.

b. If the ERROR lamp is on, press the ERROR RESET switch to put the printer offline. If the ERROR lamp does not go out, try the solution given in Section 3.3.2.

c. In either a or b above, confirm that OFLINE is being displayed and then set the MODE SELECTION switch to TEST. This places the printer in TEST mode. The TEST MODE lamp should light and TEST should be displayed.

(3) Test menu selection

The test menu explained in Table 3.5 can be selected when in test mode.

Use the FINE FORMS ADJUST ↑ or ↓ switch to select test menu items. Every time the ↑ or ↓ switch is pressed, another test menu item is displayed on the STATUS indicator. Holding the ↑ or ↓ switch down for half a second switches the menu item. When the required item is displayed, press the START/STOP switch to test that menu item. The START/STOP lamp should light. If the START/STOP switch is pressed without pressing the FINE FORMS ADJUST ↑ or ↓ switch, the shift-printing test (displayed as SFTPRT) begins.

(4) If an error is detected during test execution, the ERROR lamp lights and the printer stops. The error is reset by pressing the ERROR RESET switch. The STATUS indicator displays the TEST. For details on errors, see Section 3.3.2 and Table 3.4.

(5) Test termination

a. For the SETFL test, which terminates automatically, the START/STOP lamp goes out as soon as the test ends.

b. Tests other than the SETFL test do not terminate automatically. Press the START/STOP switch to terminate these tests. The START/STOP lamp should go out.

c. In either a or b above, the test menu returns to the initial frame after the test is terminated. To run the same test again, press the START/STOP switch again.

(6) If another test is to be run after one test terminates, repeat the procedure in (3).

(7) When all tests are finished, set the MODE SELECTION switch to NORMAL to return operation to NORMAL mode. The TEST MODE lamp should go out and OFLINE should be displayed on the STATUS indicator.

(8) Operation can be switched to NORMAL mode even though a test is in progress. Just set the MODE SELECTION switch to NORMAL.

Table 3.5 STATUS indicator display (3) - Test menu

Test menu No.	Status indicator display	Test name	Function and procedure
1	SFTPRT	Shift Printing	This test prints a shift pattern of all characters on the print band set in the printer. All printing errors and forms feed errors are detected during this test. To start the test, press the START/STOP switch while SFTPRT is displayed. The START/STOP lamp lights when the switch is pressed. Press the START/STOP switch again to stop the test. The START/STOP lamp will go out. When an error is detected during the test, the ERROR lamp lights, the error contents are displayed, and the test terminates.
2	FIXPRT	Fix Printing	This test prints the character specified in test menu 3 (FIX DT) in all print positions. All printing errors and forms feed errors are detected during the test. Press the START/STOP switch to start the test while FIXPRT is displayed. The START/STOP lamp lights when the switch is pressed. Press the START/STOP switch again to stop the test. The START/STOP lamp will go out. When an error is detected during the test, the ERROR lamp lights, the error contents are displayed, and the test terminates. If the test is run without specifying the character in test menu 3, H is printed in all print positions.

Table 3.5 - continued

Test menu No.	Status indicator display	Test name	Function and procedure
3	FIXDT	Fix Printing Data	The character to be printed in the FIXPRT and PSEADJ tests is specified in the FIX DT menu. When power is turned on, the specified character is H (default). When the START/STOP switch is pressed while FIXPRT or PSEADJ is displayed, the currently specified character is displayed as follows: PRDT=H └ Currently specified character The displayed character changes in alphabetical order every time the FORMS FINE ADJUST ▲ switch is pressed. When the ▼ switch pressed, characters are displayed in reverse order. To specify a character, press the START/STOP switch when the desired character is displayed. The specified character remains in effect until power is turned off or until another character is specified using this menu. When power is turned off, the specified character becomes the default character, H. Specifiable character codes are X'21' to X'5F'. Some printed characters are different from those displayed because of the following differences in print bands.

Characters displayed in STATUS indicator	#	$	@	[	\	]	↑	↓
(Character code: hex)	X'23'	X'24'	X'40'	X'5B'	X'5C'	X'5D'	X'5E'	X'5F'
Print band for US	#	$	@	[	\	]	^	_
Print band for UK	£	$	@	[	\	]	^	_
Print band for France	£	$	à	°	ç	§	^	_
Print band for Germany	#	$	§	Ä	Ö	Ü	^	_
Print band for Sweden	#	¤	É	Ä	Ö	Ü	ú	_
Print band for Denmark	#	$	É	Æ	Ø	Å	ú	_

Table 3.5 - continued

Test menu No.	Status indicator display	Test name	Function and procedure
4	NONPRT	Non Print Test	This test performs the print and forms feed operations without exciting the hammer magnets. All errors except those relating to hammer checks are detected during the test. When an error is detected, the error contents are displayed and the test terminates. Press the START/STOP switch to start the test. Press the START/STOP switch a second time to terminate the test.
5	PSEADJ	Horizontal synchronization adjustment in all columns	This test is used to adjust the horizontal synchronization in all columns. When the START/STOP switch is pressed while PSEADJ is displayed, the printer begins to print the character specified in the FIXDT test. The print speed is slower than in the FIXPRT test. If an error is detected during the test, the test terminates. The current value set for the test is displayed as follows: ±xxx Current test value Press the FINE FORMS ADJUST ↑ switch to increase the value; press the ↓ switch to decrease the value. The value can be any value from -063 to +063 (including 000). When the value is increased, horizontal synchronization shifts to the right. When the value is decreased, it shifts to the left. The following example shows the effect of this adjustment: H H H Value decreased (↓ switch) Value increased (↑ switch)

Table 3.5 - continued

Test menu No.	Status indicator display	Test name	Function and procedure
5	PSEADJ	Horizontal synchronization adjustment in all columns	Printed characters can be shifted a maximum of 0.46 mm (0.018") using this adjustment. If the synchronization cannot be adjusted, call a customer engineer. Since the value set in the test is not lost when power is turned off, the test does not have to be rerun when power is turned on again.
6	BNDTST	Band and Ink Ribbon Motion Test	This test checks the print band and ribbon operations. When the START/STOP switch is pressed, the START/STOP lamp lights and the print band and ribbon begin to move. They stop when the START/STOP switch is pressed again. They also stop when an error is detected.
7	RBNTST	Ribbon Motion Test	This test checks the ribbon operation. When the START/STOP switch is pressed, the START/STOP lamp lights and the ribbon begins to move. It stops when the START/STOP switch is pressed again. It also stops when an error is detected.
8	FDTST	Form Feeding Test	This test checks continuous line feeding. (The skip-over functon is also valid.) When the START/STOP switch is pressed, the START/STOP lamp lights and the forms begin to feed. The operation terminates when the START/STOP switch is pressed or if the forms jam.
9	SET FL	SET to Form Length Mode	This menu is used to change the forms feed control mode using FCB or FCT data to the form length mode. Pressing the START/STOP switch changes the mode, and automatically ends operation of the menu. When the mode is changed, the FCB or FCT data is cleared. Forms feed is then controlled by form length, which is set by the set-up mode FORM-L menu. The current print line becomes the first line of a page.

3.3.4 SET UP mode

(1) With the printer off (the POWER lamp is out), set the MODE SELECTION switch to SET UP and turn the POWER switch on. This sets the SET UP mode. The POWER lamp should light and SET UP should be displayed on the STATUS indicator.

(2) If the operation has to be switched to SET UP mode when the printer is online and in NORMAL mode, follow one of the two procedures below.

a. If the START/STOP lamp is on, press the START/STOP switch to put the printer offline.

b. If the ERROR lamp is on, press the ERROR RESET switch to put the printer offline.

(3) In either a or b above, confirm that OFLINE is displayed then set the MODE SELECTION switch to SET UP. SET UP should be displayed on the STATUS indicator.

(4) After confirming that SET UP is displayed in steps (1) or (3) above, press the START/STOP switch while pressing the ERROR RESET switch to set SET UP mode. The SET UP MENU lamp should light and LPI, the first item of the set up menu, should be displayed on the STATUS indicator.

(5) Set up menu selection (see Table 3.6)
Press one of the FINE FORMS ADJUST switches to select a SET UP menu item. The ↑ and ↓ switches change the menu items. Every time either of these switches is pressed, the menu item displayed on the STATUS indicator changes. When the required item appears, press the START/STOP switch to set the item. The SET UP FIELD lamp should light and the selected item should be displayed on the STATUS indicator.

(6) Set up field selection

a. If the item displayed on the STATUS indicator is the item needed, press the START/STOP switch to set it. The SET UP FIELD lamp should go out and the SET UP MENU lamp should light. The menu item is displayed on the STATUS indicator.

b. To change the item displayed on the STATUS indicator, use the FINE FORMS ADJUST switches to roll the menu. As when a menu item is selected, pressing the switches moves through the selection items, each of which is displayed on the STATUS indicator. When the required item appears, press the START/STOP switch to set it. The SET UP FIELD lamp should go out, the SET UP MENU lamp should light, and the selected menu item should be displayed on the STATUS indicator.

(7) When another menu field item is required, repeat the procedures explained above in items (5) and (6).

(8) When NORMAL mode is required after SET UP mode operation is finished, set the MODE SELECTION switch to NORMAL. The SET UP MENU lamp should go out and OFLINE should be displayed on the STATUS indicator.

(9) The mode can be switched from SET UP to NORMAL at any stage of SET UP mode operation.

(10) Example of set up operation
When the START/STOP lamp lights and ONLINE is displayed on the STATUS indicator, set the number of characters per line to 136.

	Operation	Lamp indication	STATUS indicator display
1	Press the START/STOP switch.	The START/STOP lamp goes off.	OFLINE
2	Set the MODE SELECTION switch to SET UP.		SET UP
3	Press the START/STOP switch and the ERROR RESET switch at the same time.	The SET UP MENU lamp lights.	LPI
4	Press the FINE FORMS ADJUST ↑ switch until the STATUS indicator displays COL 132.		COL 132
5	After confirming that COL 132 is displayed on the STATUS indicator, press the START/STOP switch.	The SET UP MENU lamp goes off and the SET UP FIELD lamp lights.	EN or DIS
6	a. If EN is displayed on the STATUS indicator, press the FINE FORMS ADJUST ↑ switch. b. If DIS is displayed on the STATUS indicator, no response is required.		DIS
7	Press the STATUS/STOP switch.	The SET UP FIELD lamp goes off and the SET UP MENU lamp lights.	COL 132
8	Set the MODE SELECTION switch to NORMAL.	The SET UP MENU lamp goes off.	OFLINE
9	Press the START/STOP switch to set the printer online.	The START/STOP lamp lights.	OFLINE

Table 3.6 STATUS display (4) - Set up menus

Set up menu No.	Set up menu	Function	Set up field	Function	Factory setting	Note
1	LPI	Forms feed pitch is set.	6LPI 8LPI	6 lines/inch 8 lines/inch	6LPI	
2	FORM-L	Forms length is set.	018LIN 019LIN 020LIN . . . 199LIN	18 lines/page 19 lines/page 20 lines/page . . . 199 lines/pare	066LIN	This display is invalid when FCB or FCT data is used.
3	SKIPOV	Perforation, skip-over, and count are set.	000LIN 001LIN 002LIN . . . 015LIN	No lines are skipped. 1 line is skipped. 2 lines are skipped. . . . 15 lines are skipped.	003LIN	
4	BOFCH	The BOF channel is set.	000 001 002 . . 012	BOF skip-over is invalid. BOF channel is 1. BOF channel is 2. . . BOF channel is 12.	0	After the BOF channel number has been set, the BOF channel number changes to that set when the FCB or FCT data is loaded. If the BOF channel is set to 1, the last line of a page becomes the BOF line.
5	AUT NL	The CR code function is set.	DIS EN	The printer only prints. It does not feed forms. The printer prints one line and feeds one line (the same as the LF code).	DIS	

Table 3.6 - continued

Set up menu No.	Set up menu	Function	Set up field	Function	Factory setting	Note
6	COL132	The print position is set.	EN DIS	132 characters/line 136 characters/line	DIS	
7	SP63	The number of form feed lines for the SPACE command is set.	EN DIS	The number of form feed lines for the SPACE command is from 0 to 63. The number of form feed lines for the SPACE command is from 0 to 15.	DIS	
8	TRNCT	Step count truncate is set up.	EN DIS	If the end line of the specified forms feed exceeds the next page TOF when a SPACE command is received, the printer executes forms feeds up to the TOF line and stops. When a SPACE command is received, the printer feeds forms up to the end line of the specified forms feed.	EN	
9	WIF8	The 7-bit/8-bit mode is set.	EN DIS	WIF 8 is valid and the printer operates in 8-bit mode. WIF 8 is invalid and the printer operates in 7-bit mode.	DIS	
10	P-INST	Validity of paper instruction signals is set.	EN DIS	Paper instruction signals are valid, the space/skip command can be used, and FCB loading is possible. Paper instruction signals are invalid.	DIS	

Table 3.6 - continued

Set up menu No.	Set up menu	Function	Set up field	Function	Factory setting	Note
11	OUTSIG	Validity of paper move, TOF, BOF, and IDENT O/1 signals is set.		o: valid (output) x: invalid (no output)	000	
			000	IDENT I/O: x, BOF: x, TOF: x, Paper move: x		
			001	IDENT I/O: x, BOF: x, TOF: x, Paper move: o		
			002	IDENT I/O: x, BOF: x, TOF: o, Paper move: x		
			003	IDENT I/O: x, BOF: x, TOF: o, Paper move: o		
			004	IDENT I/O: x, BOF: o, TOF: x, Paper move: x		
			005	IDENT I/O: x, BOF: o, TOF: x, Paper move: o		
			006	IDENT I/O: x, BOF: o, TOF: o, Paper move: x		
			007	IDENT I/O: x, BOF: o, TOF: o, Paper move: o		
			008	IDENT I/O: o, BOF: x, TOF: x, Paper move: x		
			009	IDENT I/O: o, BOF: x, TOF: x, Paper move: o		
			010	IDENT I/O: o, BOF: x, TOF: o, Paper move: x		
			011	IDENT I/O: o, BOF: x, TOF: o, Paper move: o		
			012	IDENT I/O: o, BOF: o, TOF: x, Paper move: x		
			013	IDENT I/O: o, BOF: o, TOF: x, Paper move: o		
			014	IDENT I/O: o, BOF: o, TOF: o, Paper move: x		
			015	IDENT I/O: o, BOF: o, TOF: o, Paper move: o		
12	IFSH1	The logic of the interface signals is set (excluding buffer clear signals).	EN	When the interface signal is high (+5 V), the operation is regarded as true (1). When it is low (0 V), the operation is regarded as false (0).	DIS	
			DIS	When the interface signal is low (0 V), the operation is regarded as true (1). When it is high (+5 V), the operation is regarded as false (0).		

Table 3.6 - continued

Set up menu No.	Set up menu	Function	Set up field	Function	Factory setting	Note
13	BCLHI	The logic of the buffer clear signals is set.	EN	When the buffer clear signal is high (+5 V), the operation is regarded as true (1). When it is low (0 V), the operation is regarded as false (0).	DIS	
			DIS	When the buffer clear signal is low (0 V), the operation is regarded as true (1). When it is high (+5 V), the operation is regarded as false (0).		
14	PARITY	Parity checking enable/disable is set.	EN	Parity checking is enabled. Checking conditions are selected on the next two set up menus.	DIS	
			DIS	Parity checking is disabled.		
15	WIF1-8	Parity checking signals are set.	EN	The WIF1-8 signals check the parity.	DIS	When DIS is selected in the PARITY menu, this set up menu is invalid.
			DIS	The WIF1-7 and PI signals check the parity.		
16	EVEN-P	Even/odd parity checking is set.	EN	Even parity is checked.(When an odd parity code is received, a parity error occurs.)	DIS	When DIS is selected in the PARITY menu, this set up menu is invalid.
			DIS	Odd parity is checked. (When an even parity code is received a parity error occurs.)		

3.3.5 Forms mounting and print adjustments

(1) When the START/STOP lamp is on, press the START/STOP switch to put the printer offline.
(2) Lift the top cover.
(3) Press the TOP OF FORM switch. Ensure that the TOP OF FORM lamp is on.
(4) Lift the THROAT OPEN lever to unlock the print unit and open the forms path A (see Figure 3.5). This also pulls plate C upward.

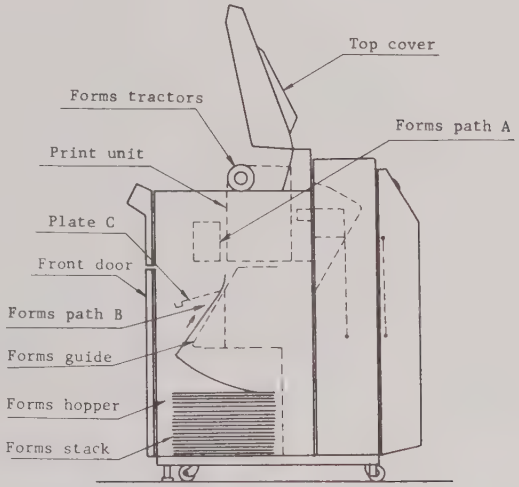


Figure 3.5 Forms mounting sequence (1)

(5) Open the front door.
(6) Place forms in the forms hopper. The forms specifications are shown in Appendix 1.
(7) Insert the top sheet into forms path B (the slot between plate and forms guide) and push it upward.
(8) Pull the first sheet out from the upper forms path A and mount it on the left and right forms tractors (see Figures 3.6, 3.7).
(9) Cover the forms with the tractor covers.

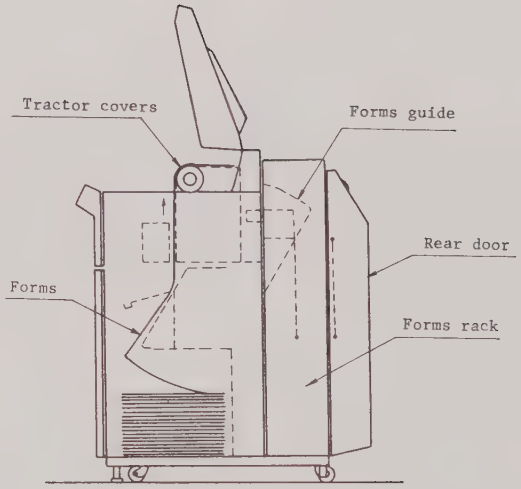


Figure 3.6 Forms mounting sequence (2)

(10) Align the top-of-form position (the first printing line position) with the line scale on the left forms tractor, using the ADVANCE FORMS knob for rough adjustment. (See Figure 3.7 and 3.1.2. (2)).

Figure 3.8 shows an example in which the line space is 6LPI, the top-of-form position is the third line, and the paper vertical dimension is 11 inches.

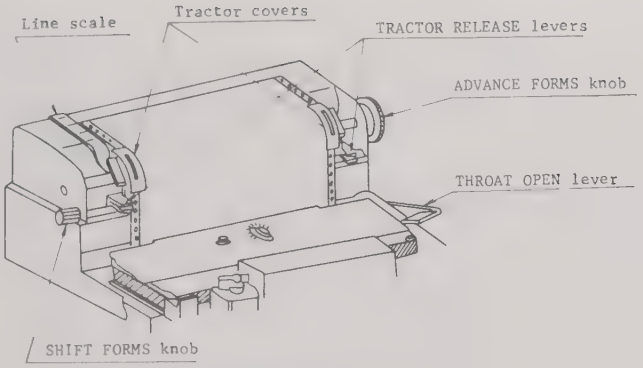


Figure 3.7 Forms adjustment

(11) Adjust the lateral tension of the forms using the TRACTOR RELEASE levers (see Figure 3.7).

The forms require tension in the range where feed holes of the forms will not be damaged during printing.

(12) Adjust the horizontal print position by using the SHIFT FORMS knob (see Figure 3.7).

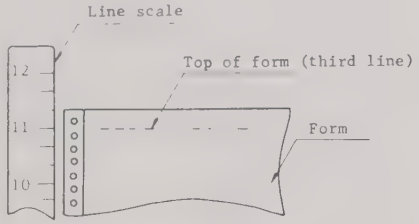


Figure 3.8 Example of forms alignment

(13) Adjust the position of the forms in the forms hopper to enable the forms to move straight into the printer.

(14) Move the THROAT OPEN lever down to lock the print unit.

(15) If necessary, use the FINE FORMS ADJUST switches to align the top-of-form position. Then pull them slightly downward to make the paper taut.

(16) Close the front door.

(17) For best print quality, set the FORMS THICKNESS knob according to the forms thickness. When the forms are thin, turn the knob clockwise; when the forms are thick, turn counterclockwise.

Note that incorrect adjustment causes print failures such as missing characters or parts of characters.

(18) Close the top cover.

(19) Press the START/STOP switch to put the printer online.

(20) Ensure that the forms come out from the printer. After the top reaches the forms rack bottom, fold the leading top of the forms so that the creases of the forms are folded in the same direction as before (see Figure 3.9).

The forms rack allows about 200 to 300 sheets of standard forms to be folded continuously. But, the number of sheets varies considerably depending on the forms quality, size, the number of plies, and print pattern.

If the forms accommodated in the forms rack are stacked as shown in Figure 3.10, folding forms is impossible thereafter.

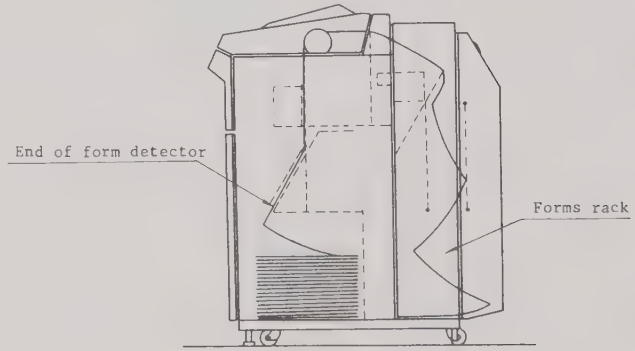
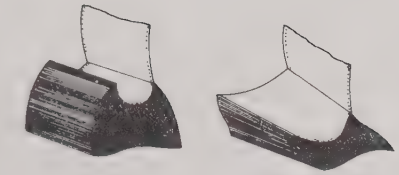


Figure 3.9 Forms path



a. When the top face of the forms curls like U.

b. When the forms are displaced or twisted gradually.

Figure 3.10 Forms posture causing fold failures

(21) When the forms are used up, the end of forms detector (see Figure 3.9) detects the end of the forms and FORM is displayed on the STATUS indicator. Printer operation stops once all printing is finished. When printer operation stops, press the TOP OF FORM switch to feed the used forms out to the forms rack.

New forms should be loaded in the printer as explained in item (1) below.

3.3.6 Ribbon replacement

Figure 3.11 shows the ribbon path.

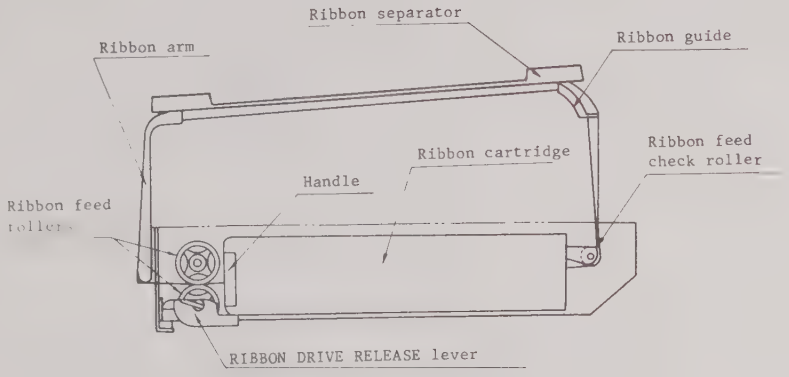


Figure 3.11 Ribbon path

(1) Removal sequence

a. If the START/STOP lamp is on, press the START/STOP switch to set the printer offline.

b. Open the top cover.

c. Lift the THROAT OPEN lever to unlock the print unit.

d. Pull the RIBBON DRIVE RELEASE lever toward you to increase the ribbon feed roller clearance.

e. Grasping the handle on the left side of the ribbon cartridge, carefully remove the cartridge, pressing the ribbon where it exits the cartridge to prevent the ribbon inside from coming out.

(2) Mounting sequence

a. Pull a short length of ribbon out of the right side of the cartridge, hang the ribbon over the ribbon feed check roller, and push the cartridge into the ribbon case (see Figure 3.12 a).

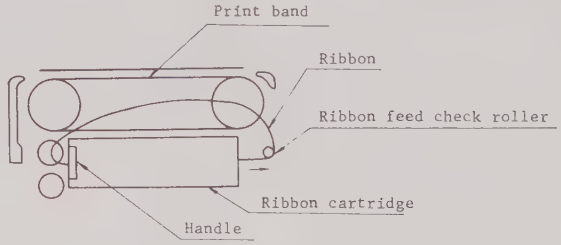
b. Pull a short length of ribbon out of the left side of the cartridge, pass the ribbon through the ribbon feed roller, hang the ribbon over the left side ribbon arm, pass the ribbon between the ribbon separator and the print band, and hang the ribbon over the right side ribbon guide (see Figure 3.12 b).

c. Push the RIBBON DRIVE RELEASE lever back to its original position.

d. Turn the ribbon feed roller by hand to take up the ribbon slack (see Figure 3.12 c).

e. Make sure the ribbon is not slack or twisted.

f. Push the THROAT OPEN lever down to lock the print unit into place.



(a)

Figure 3.12 Ribbon mounting sequence

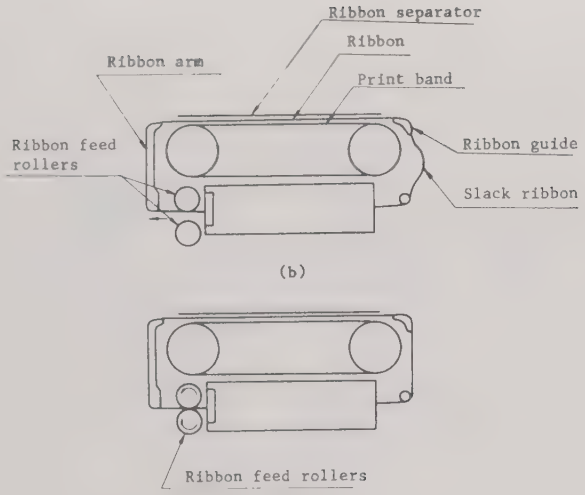


Figure 3.12 - continued

3.3.7 Print band replacement

(1) Removal sequence

a. If the START/STOP lamp is on, press the START/STOP switch on the operator panel.
b. Open the top cover.
c. Lift the THROAT OPEN lever to unlock the print unit (see Figure 3.13).
d. Lift the BAND COVER latch on the top of the band cover and open the cover.
e. Remove the ribbon separator. (See Section 3.3.8.)
f. Turn the BAND EXCHANGE knob to the BAND EXCHANGE position. This shifts the band pulley to the idler side, narrowing the distance between the two print band pulleys (idler and drive sides) and freeing the print band.
g. Lift the left ribbon arm to keep the ribbon raised.
h. Hold the left and right ends of the print band and carefully lift the print band upward.

Be careful so as not to touch the print band to the ribbon separator, platen, PSE sensor, etc., or to touch the print band with a magnet or screwdriver.

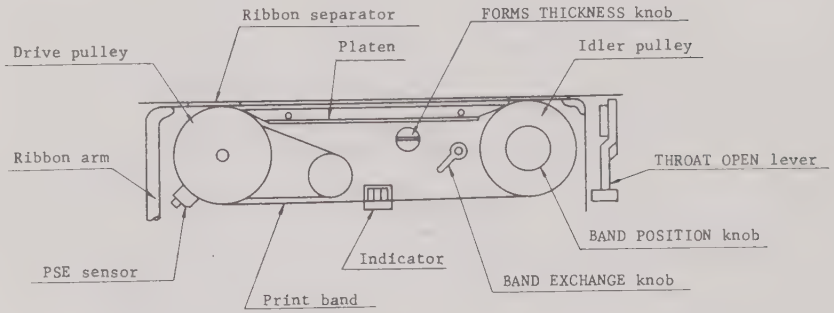


Figure 3.13 Print band assembly

(2) Mounting sequence

a. Insert the print band between the ribbon separator and platen.
b. Hang the print band on the two pulleys (drive and idler), taking care to avoid hitting the PSE sensor with the print band. The print band should be mounted so that the print band rims and the upper and lower faces of the pulleys are aligned as shown in Figure 3.14.

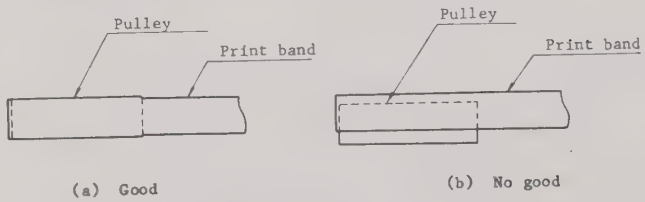


Figure 3.14 Print band mounting

c. Turn the BAND EXCHANGE knob to NORMAL.
d. Turn the idler pulley counterclockwise by hand until the print band is in place (about ten turns).
e. Adjust the print band position using the BAND POSITION knob while watching the indicator lens from above.
   See Figure 3.15 for proper alignment.
f. Insert the new ribbon separator until it is seated.

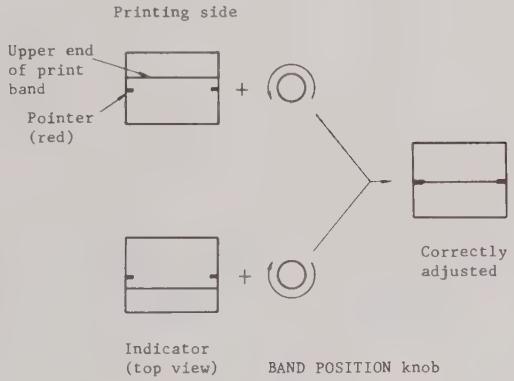


Figure 3.15 Adjusting the print band position

g. Close the band cover.
h. Pull the ribbon arm down and turn the ribbon feed roller to take out any ribbon slack.
i. Close the THROAT OPEN lever.

(3) Warnings
   a. Do not fold or twist the print band.
   b. Do not start the print unit without locking the band cover.

3.3.8 Ribbon separator replacement

(1) If the START/STOP lamp is on, press the START/STOP switch to set the printer offline.
(2) Open the top cover.
(3) Lift the THROAT OPEN lever to unlock the print unit lock.
(4) Hold the ribbon separator on the right and left and gently pull it out.
(5) Insert the new ribbon separator until it stops and the notch in the separator appears on the left side. Be careful not to switch the right and left sides.
(6) Push the THROAT OPEN lever down, making sure that the pins on the right and left holes of the ribbon separator are aligned properly and that the ribbon separator does not slip upward out of position.
(7) Close the top cover.

3.3.9 Cleaning

(1) When replacing the ribbon, the operator should clean the following parts after removing the ribbon cartridge (see 3.3.7).
   a. Ribbon cartridge container and its peripheral region (See Figure 3.16.)
      Remove ribbon lint with a vacuum cleaner and a soft cloth.
   b. Ribbon feed rollers
      Remove ribbon lint with a soft cloth or sponge.
      Caution: Never use solvents such as alcohol.
   c. Ribbon arm, ribbon guide and ribbon feed check roller
      Remove ribbon lint and ink with a soft cloth or sponge.
   d. Print band and its peripheral region
      Remove the band cover. Moving the print band by turning the band pulley (idler pulley) counterclockwise by hand, clean the dirty or clogged type faces with a brush.
      Caution: Never wipe the inside of the print band (back side of type) with solvents such as alcohol. Remove ribbon lint and paper lint around the print band with a vacuum cleaner.

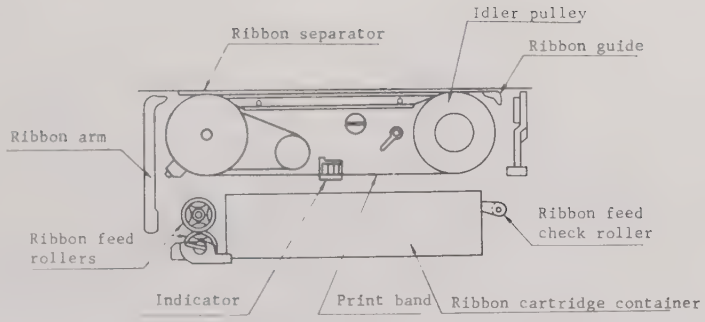


Figure 3.16 Ribbon feed unit and print band unit

e. Tractor shaft (see Figure 3.17.)
Remove the forms guide.
Remove dirt from the tractor shaft with a soft cloth such as gauze.

f. Forms feed tractors, horizontal adjust plate and their peripheral region
Remove forms lint, dust, etc., with a vacuum cleaner.

g. Ribbon separator
Remove the ribbon separator (see 3.3.9).
Remove ribbon lint, forms lint, etc., with a vacuum cleaner and wipe off dried ink with a cloth wet with ligroin or alcohol.

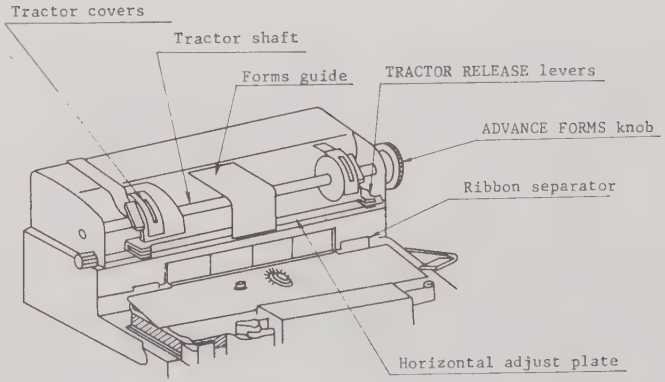


Figure 3.17 Forms feed unit

(2) Clean the forms hopper with a vacuum cleaner if dust has collected in it.
(3) Caution
a. For safety, be sure to turn off power before cleaning.
b. Clean only places that can be seen from the operation side.

3.3.11 Precautions

(1) Once power is turned off, do not turn it on again within 30 seconds.
(2) Do not press switches unnecessarily during operation.
(3) Do not attempt to adjust beyond the ranges indicated by the adjustment knobs in the mechanical section. Excessive turning will cause failure.
(4) Never touch screws or open covers, etc., not directly related to operation. The printer mechanical section is precision built, and unnecessary adjustments will cause a malfunction or failure.
(5) Never print with no forms mounted.
(6) Lubrication is performed at maintenance time, and is usually unnecessary at other times.
(7) The printer gets dirty quickly because it uses paper. Thus, it must be cleaned at times, to meet your environmental standards.

CHAPTER 4
THEORY OF OPERATION

This chapter explains the configuration and operation of this printer. Details on the input/output interfaces are given in the appendix.

4.1 Introduction

This printer is divided into three parts: mechanical unit, control unit for print operations, and power supply. The control unit is connected to the mainframe through the input/output interface and is used to transfer data.

This section outlines these operations.

4.1.1 Operation outline

The continuous forms set in the forms hopper are advanced, passed through the end-of-forms sensor, then printed at the print section. The forms are advanced by two forms tractors and sent to the forms rack. The movement of the forms is shown in Figure 4.1.

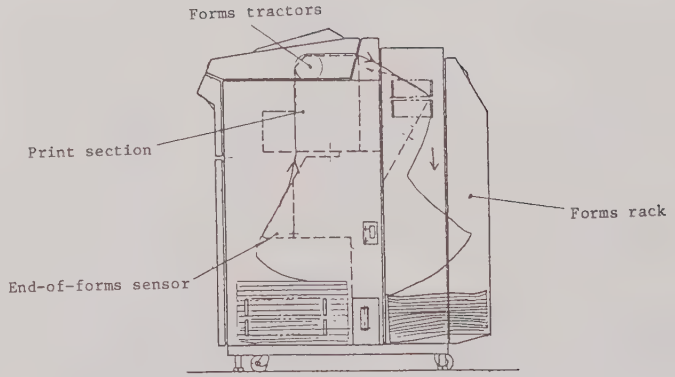


Figure 4.1 Movement of forms

This printer is controlled by two microprocessors. One microprocessor controls the I/O interface and the other controls the printer. The control microprogram of these microprocessors is stored in the printer memory.

When power is supplied to this printer, the initial state of the printer is diagnosed by the microprogram. The printer then remains offline until the operator presses the START/STOP switch. When the START/STOP switch is pressed, the printer comes online and data can be received. If the START/STOP switch is pressed again or an error is detected, the printer goes offline. The switches and indicators on the operator panel can be used in this state. Test printing is also done in this state.

Data is processed after it has been received in the online state from the I/O interface. The equipment selects the appropriate characters from the continuously rotating print band and prints them on the forms using a print hammer. When the printing of one line has been completed, the form is advanced one line.

4.1.2 Basic operation cycles

The basic operation of this equipment is divided into three cycles: data transfer, printing, and forms feed. Figure 4.2 shows the relationship of these cycles.

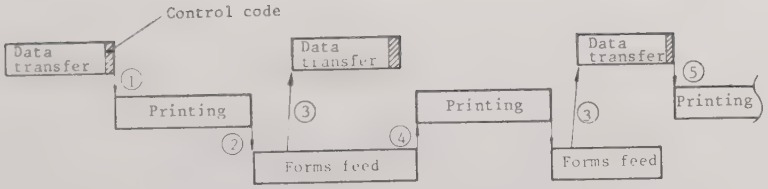


Figure 4.2 Relationship of the basic operation cycles

When this printer is online and data transfer is started, data is transferred to the printer buffer. When the control code transferred at the end of the data is received, the printer starts printing. (①)

When print data received before reception of the control code is less than 136 columns, the remaining columns are filled with space codes (not printed). The data received first is printed at the first column, the data received second is printed at the second column and so on. Printing is started from a printable column depending on character position on the rotating print band. When all columns are printed, the forms feed operation is started. (②)

This printer is enabled to receive data when control of the last line of specified forms feed lines starts. The printer reports to the mainframe that it has entered the data receivable state. If the next print line data is prepared, the mainframe starts data transfer. (3) At this time, the printer stores the next line of data to be printed in the internal buffer while feeding forms.

If data transfer terminates during forms feed, printing starts after forms feed is completed (④). If data transfer is not completed, printing starts after data transfer is completed. (⑤) Therefore, if data transfer is not completed during forms feeding, the printing speed is reduced.

4.2 Mechanical Unit

The mechanical unit is mounted in the cabinet. The mechanism is controlled by the control unit and performs printing and forms feeding.

The base unit, print unit, forms feed unit, and ribbon unit of the mechanical unit execute the following operations.

4.2.1 Base unit

The base unit is mounted in the cabinet on rubber shock absorbers. The base unit consists of the print band drive mechanism, PSE sensor, and several adjustment mechanisms. It rotates the print band at a constant speed.

Figure 4.3 shows the configuration of the base unit.

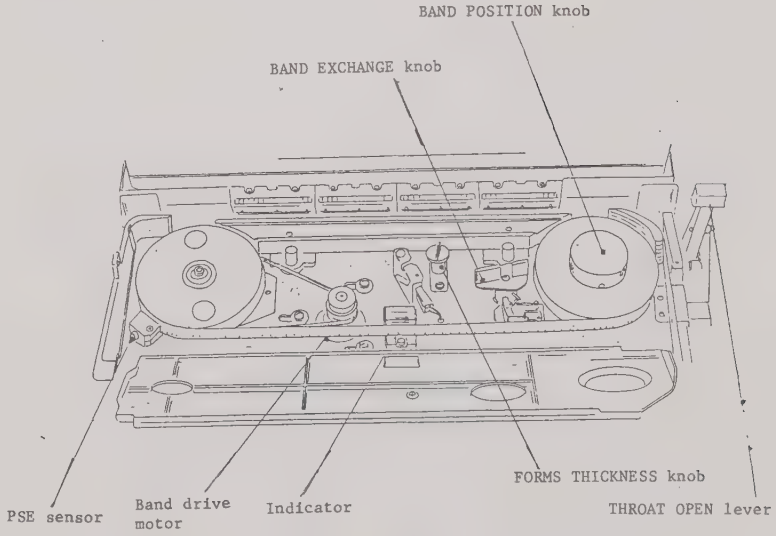


Figure 4.3 Base unit configuration (band cover removed)

(1) Print band drive mechanism

The print band drive mechanism consists of the band drive motor, drive pulley assembly, and idler pulley assembly, each of which is mounted on a base frame.

a. Band drive motor

The band drive motor is driven by 100 VAC. Two types are provided: M3040/M3041 and M3042. The band drive motor rotations are transmitted to the drive pulley by the V-belt movement or V-shaped grooves of the drive pulley and the motor pulley attached to the motor shaft. The band drive motor is fixed through oblong holes which enable adjustment of the V-belt tension.

b. Drive pulley assembly

The drive pulley assembly consists of the drive pulley, drive pulley shaft, and the metal plate securing this shaft on the base frame. Figure 4.4 shows the structure of the drive pulley assembly.

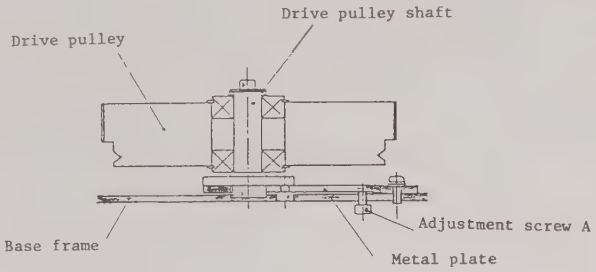


Figure 4.4 Structure of the drive pulley assembly

As shown in Figure 4.4, the drive pulley is fixed to the shaft through two bearings and rotates around the fixed shaft. The upper part of the drive pulley has a crowned rubber lining so that when both the drive pulley and idler pulley shafts are vertical to the base frame, the position of the print band running on these two pulleys is kept constant and the print band is prevented from coming off the pulleys.

The shaft of the drive pulley is fixed to the metal plate by screwing it into the metal plate. Since the metal plate is fixed at the shaft position of the base frame through a washer, there is a 1-mm gap between the metal plate and the base frame. By slightly changing the angle of the metal plate by adjusting screw A as shown in Figure 4.4, drive pulley shaft tilt, caused by a slight warp or distortion of the base frame, can be adjusted. This screw must not be adjusted because of precision factory settings.
special jigs.

c. Idler pulley assembly

The idler pulley assembly consists of the idler pulley, idler pulley shaft, slider (the bearing of the idler pulley shaft), and the print band position-adjusting knob (BAND POSITION knob). Figure 4.5 shows the structure of the idler pulley assembly.

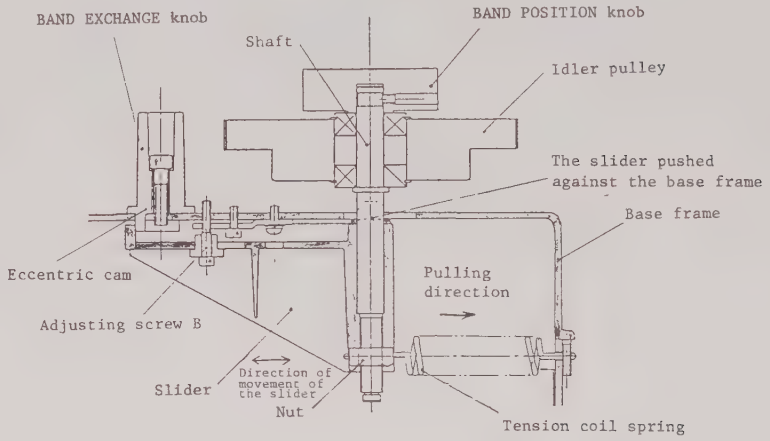


Figure 4.5 Structure of the idler pulley assembly

As shown in Figure 4.5, the idler pulley is mounted on the shaft through two bearings in the same way as the drive pulley. Because the upper part of the idler pulley also has a crowned rubber lining, the idler pulley automatically holds the print band position in the same way as the drive pulley.

The shaft of the idler pulley is screwed into the nut located in the lower part of the slider and is secured. The height of the idler pulley can be adjusted by this screw mechanism.

As shown in Figure 4.5, the slider can be moved in the direction of the arrow, pulled to the right by the tension coil spring, as viewed from the front of the printer, and positioned with adjusting screw B so as to be vertical to the base frame. Both upper shoulders of the slider bearing are pressed against the base frame. Therefore, the verticality of the idler pulley to the base frame can be adjusted by adjusting the angle of the slider with adjusting screw B. However, adjusting screw B is not suggested because of precision factory settings.

The idler pulley assembly is pulled by the tension coil spring and the print band running on the idler pulley is pulled.

(2) PSE sensor

The PSE sensor has a magnet in the coil and converts changes in the magnetic field to voltage. The PSE sensor detects the clock marks and home pulse marks on the print band rotating on the drive pulley to generate PSE pulse signals. The position of the PSE sensor housing can be adjusted by ±1.5 characters in a circle in relation to the drive pulley shaft. This can be adjusted to correct positional errors of the PSE sensor for each model of the M304x series. The gap between the PSE sensor head and clock mark can be adjusted to generate the optimum PSE pulse.

Figure 4.6 shows the relationship of the PSE sensor and print band.

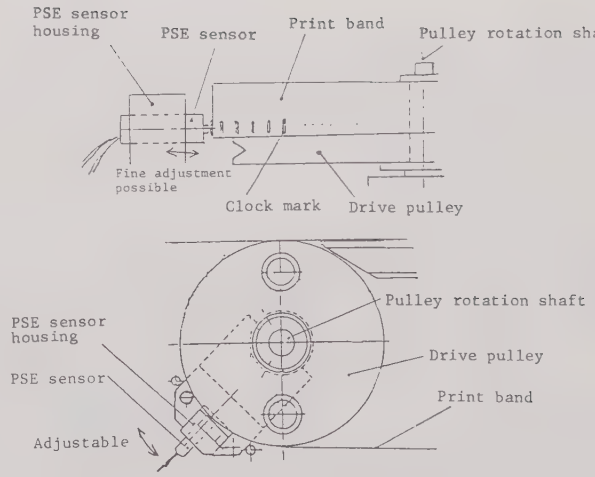


Figure 4.6 Relationship of the PSE sensor and print band

(3) Adjustment and operation mechanism

The base unit has a BAND EXCHANGE knob for changing the print band, a BAND POSITION knob for adjusting the vertical position of the print band, a FORMS THICKNESS knob, and THROAT OPEN lever. The BAND EXCHANGE and BAND POSITION knobs are located under the band cover. Open this cover when changing or adjusting the band.

a. BAND EXCHANGE knob

The BAND EXCHANGE knob is mounted on the base frame and can be rotated 360°. This knob has an eccentric cam fitted under the base frame. As shown in Figure 4.5, the slider is made to push against the eccentric cam by the tension coil spring and to slide in the direction opposite to the pull of the tension coil spring, thus shifting the idler pulley position. In this position, the print band can be changed.

b. BAND POSITION knob

As shown in Figure 4.5, the BAND POSITION knob is fixed on the idler pulley shaft. Because the idler pulley shaft is screwed into the nut located in the lower part of the slider, the height of the idler pulley and the vertical position of the print band can be adjusted by rotating this knob.

An indicator is provided on the base frame to check the vertical position of the print band. Figure 4.7 shows the indicator.

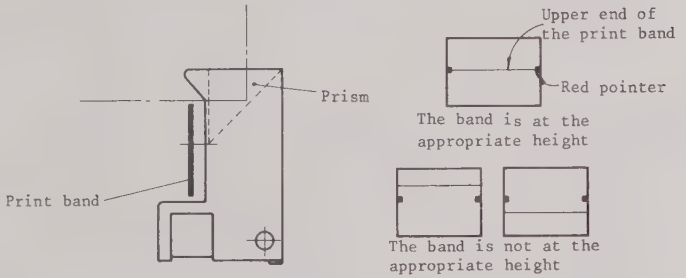

Prism
Print band
Upper end of the print band
Red pointer
The band is at the appropriate height
The band is not at the appropriate height

Figure 4.7 Indicator

As shown in Figure 4.7, the upper end of the print band can be seen from above with the prism inside the indicator. Red pointers are provided in the top face of the prism. The indicator position has been adjusted at the factory by special jigs so that the appropriate height is obtained when the upper end of the print band is aligned with the red pointers. If the print band deviates from the appropriate height, it will not be aligned with the red pointers. Do not move the indicator position because it is very difficult to adjust without using the special jigs.

c. FORMS THICKNESS knob

As shown in Figure 4.8, the FORMS THICKNESS knob has a cylindrical cam, which is located under the base frame. A bracket is attached to the pipe perpendicular to this cylindrical cam and passing to the left and right through the base unit. A projection on the bracket engages with the slot of the cylindrical cam. As shown in Figure 4.9, eccentric parts are fitted at both ends of the pipe so that the pipe and shaft centers are eccentrically located. A cam is fitted to this shaft through the arm and adjusting shaft at both sides. The arm and adjusting shaft are used to adjust the left and right sides of the gap through which the forms pass. Since adjustments have been made at the factory, do not loosen screw C or rotate the adjusting shaft. The print unit is pressed to the cam by the compression counterforce of the rubber damper.

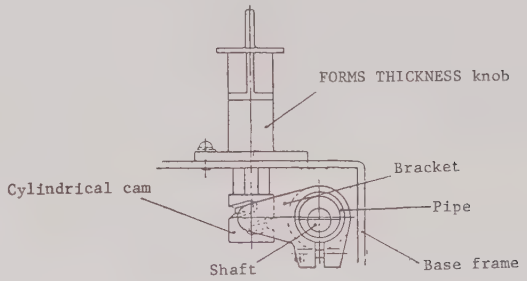


Figure 4.8 FORMS THICKNESS knob

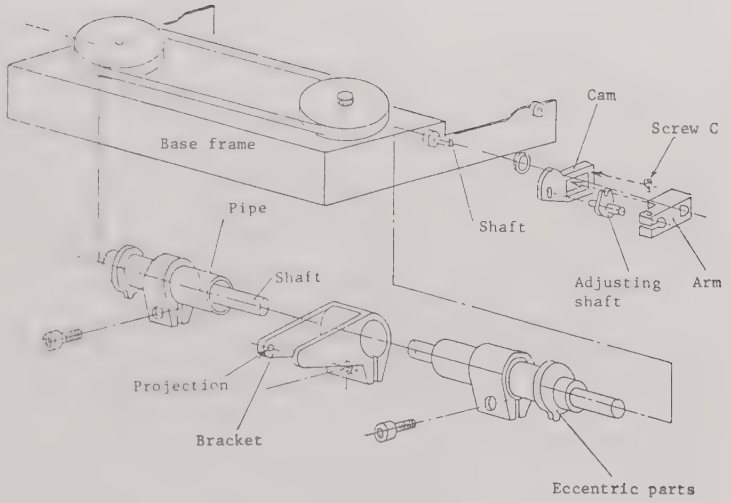


Figure 4.9 FORMS THICKNESS adjusting mechanism

When the FORMS THICKNESS knob is rotated, the bracket engaged with the cylindrical cam is slightly rotated and the pipe is also rotated. With the rotation of the pipe, the eccentric parts at both ends of the pipe also rotate and the shaft rotates in the center of the pipe. The engaged cam moves the print unit back and forth slightly. The distance between the hammer and platen can then be correctly adjusted.

d. THROAT OPEN lever

As shown in Figure 4.10, the THROAT OPEN lever rotates around the fulcrum attached to the base frame. This lever is coupled with the cam at the oblong hole in center of the lever. When this lever is raised, the cam rotates around the shaft and moves the print unit, which is pressed backward against the cam. The lever and the forms feeler of the end-of-forms sensor are connected with wire so that the forms feeler is also raised when the lever is raised. The forms passage is enlarged by raising the lever; thus, forms can be inserted more easily.

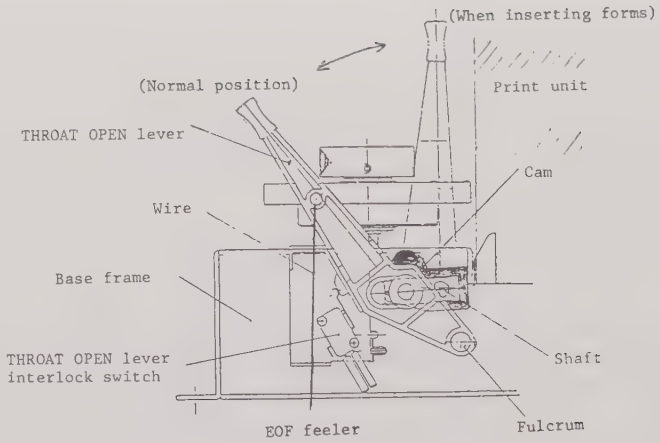


Figure 4.10 THROAT OPEN lever

4.2.2 Print unit

One hundred thirty-six hammer magnets are mounted on the print unit to strike type on the print band during printing.

The print unit consists of the frame, four hammer magnet assemblies, right and left side plates, plates for positioning the hammer magnet assemblies, and a rubber forms compressor to prevent the forms from slipping. Figure 4.11 shows the configuration of the print unit.

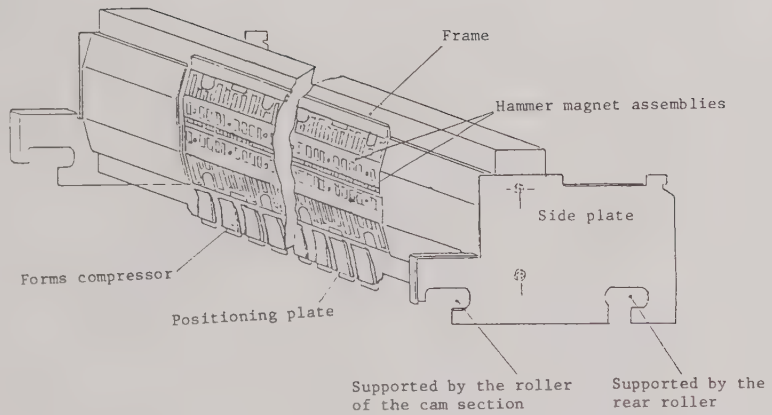


Figure 4.11 Print unit configuration

As shown in Figure 4.11, the print unit is supported at four places by the right and left rollers of the cam sections and the right and left rear rollers, which determine the front-to-back and vertical positions of the print unit in relation to the base frame. The horizontal positions are determined by correctly inserting the straight pins under the lower left of the frame into the oblong hole of the base frame. When the THROAT OPEN lever is raised, the print unit can be removed by pulling it upward.

The hammer magnet assembly consists of the hammer assembly and magnet assembly. As shown in Figure 4.12, the lower hammer magnet assembly is positioned exactly by butting the slot face against the positioning plate. Because the upper and lower hammer magnet assemblies are arranged so that their hammers alternate, the upper hammer magnet assembly is positioned so that the gaps between the hammers of the upper and lower hammer magnet assemblies are equal.

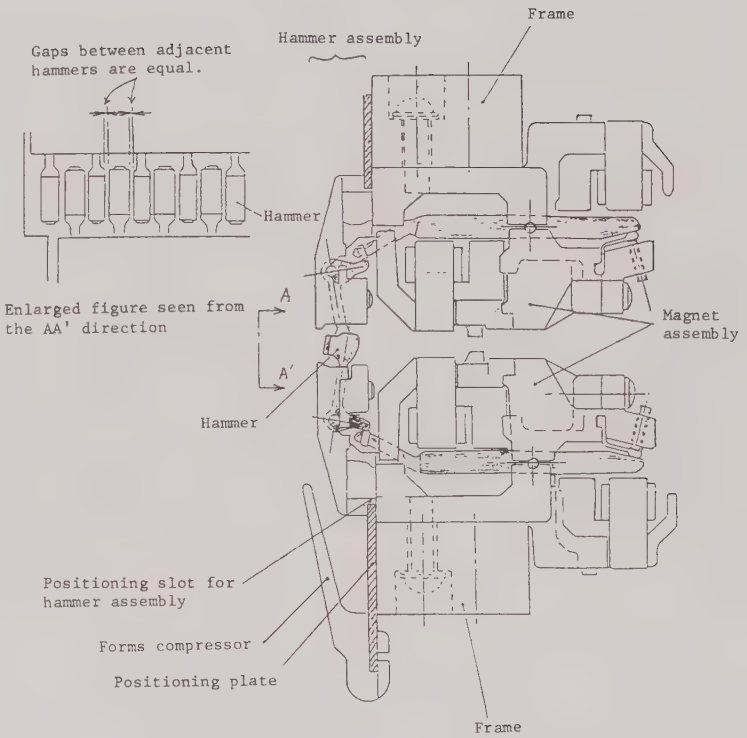


Figure 4.12 Hammer magnet assembly

The hammer assembly has 34 hammers, each of which rotates around the hammer shaft. The hammer is usually pushed by the return spring (compression coil spring) by means of a plunger and kept away from the print surface.

Figure 4.13 shows the structure of the hammer assembly.

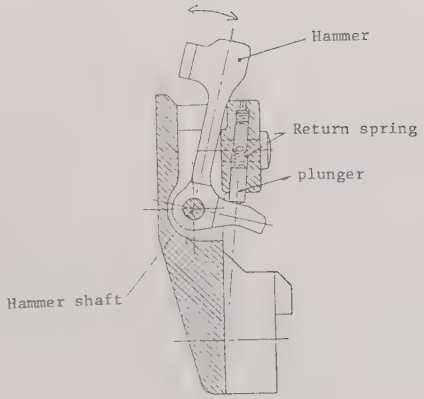


Figure 4.13 Structure of hammer assembly

One magnet assembly is mounted with two sets of 17 printing magnets located at its upper and lower parts and, as shown in Figure 4.14, each magnet attracts an armature when magnetized. The attracted armature moves the hammer at the same time. When struck by the armature, the hammer strikes the form even though the armature stops. This is called hammer free flight. The hammer strikes the type on the print band and prints the character through the forms and ribbon.

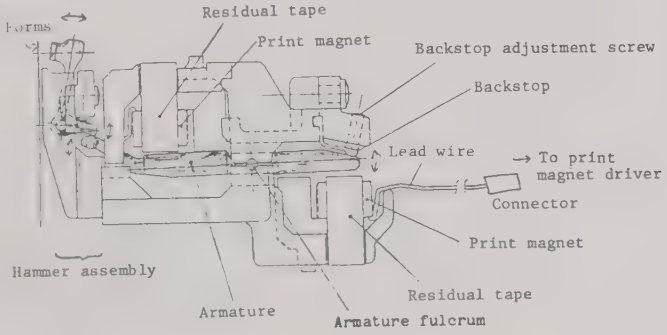


Figure 4.14 Magnet assembly

After the print magnet ceases to be magnetized, the hammer returns by the force of the return spring and the armature also returns to its original position and stops at the backstop.

The return stop position can be adjusted by adjusting the height of the backstop using the adjusting screw. This adjustment changes the hammer flight time (from when the hammer starts to when it strikes the forms), so that the print timing can be adjusted.

A residual tape is inserted so that the armature leaves the core immediately when the armature is attracted and strikes the print magnet.

4.2.3 Forms feed unit

The forms feed unit is secured to the print unit. The forms feed unit consists of forms tractors, which slide the forms feed shaft right and left, and the forms tractor drive mechanism, which drives them.

Figure 4.15 shows the structure of the forms feed unit.

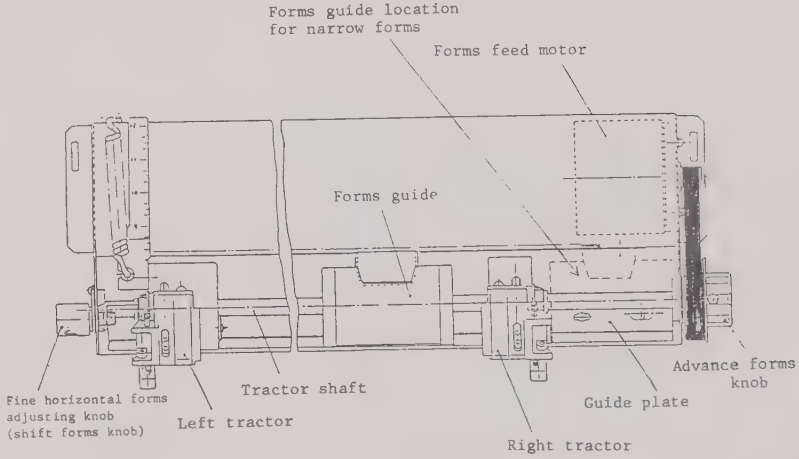


Figure 4.15 Configuration of the forms unit

The forms guide shown in Figure 4.15 is usually positioned between the right and left tractors. For narrow forms (less than 7 inches), it is positioned outside the tractors.

For maintenance purposes only

(1) Forms tractors

The right and left tractors are asymmetrical. The left tractor is equipped with a sensor to check forms feed and a scale for determining the forms setting position in accordance with the length of each page.

Figure 4.16 shows the structure of the left tractor.

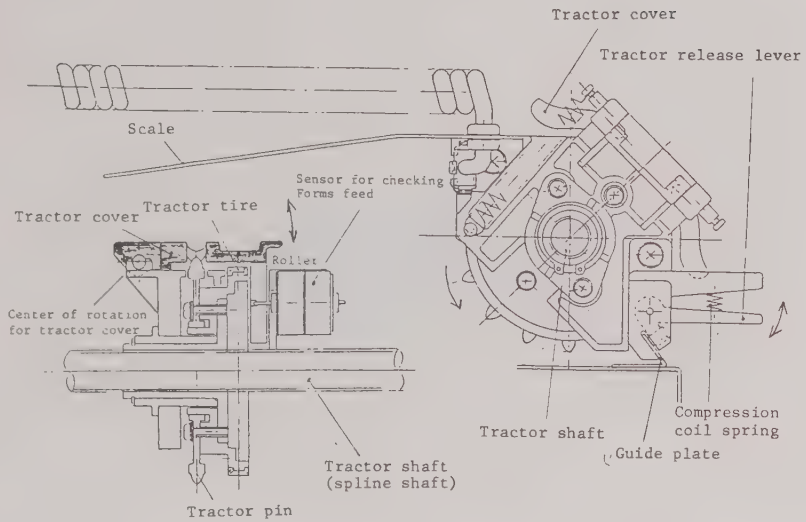


Figure 4.16 Structure of the left tractor

As shown in Figure 4.16, the tractor shaft is splined so as to transmit the turning force to the tractor bearings and thus enable horizontal movement. There is also a guide plate for moving the tractor left and right in parallel with the tractor shaft. Because the lever usually opens by the compression coil spring inside the tractor release lever and pushes the guide plate through the rubber plate, the tractor remains fixed in one position.

The tractors feed forms by engaging the tractor pins in the pin holes. In addition, the tractor tire is mounted at the position shown in Figure 4.16. Forms are fed by the tractor pins and by the friction between the forms and tractor wheel.

The sensor for checking the feeding of forms consists of a roller attached to the shaft of the stepper motor. When forms are fed, the roller rotates by friction with the forms and voltage is generated in the stepper motor. By monitoring this voltage, the forms feed state can be checked.

(2) Forms tractor drive mechanism

The tractor drive mechanism is mounted on the frame of the forms feed unit. It transmits the rotations of the forms feed motor to the tractor shaft by two timing pulleys, large and small, and a timing belt. The advance forms knob is attached to the tractor shaft.

The forms feed motor is a stepper motor. Oblong holes are provided in the frame for mounting the motor so that, by changing the mounting position, the tension of the timing belt can be adjusted.

Figure 4.17 shows the tractor drive mechanism.

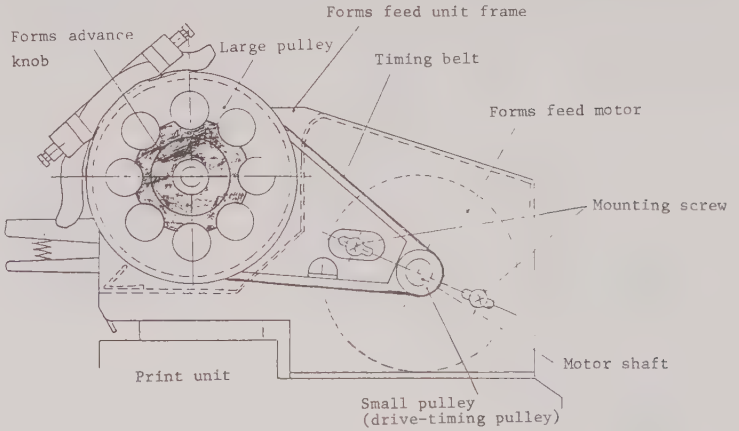


Figure 4.17 Tractor drive mechanism

The forms feed unit frame is mounted, as previously stated, to the tractor guide plate and can be moved left and right. As shown in Figure 4.18, the fine adjustment mechanism of the shift forms knob is located at the left end of this guide plate. By turning the threaded part of this knob, the guide engaging it can be moved slightly to the left and right and the positions of the left and right tractors can be fine adjusted.

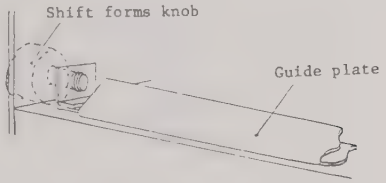


Figure 4.18 Shift forms knob

4.2.4 Ribbon unit

The ribbon unit is attached to the base unit. It consists of the ribbon drive mechanism and ribbon feed sensor. The ribbons are stored in the ribbon cartridge and the cartridge is then set in the ribbon container. Otherwise, ribbons are directly stored in the ribbon container without using a cartridge. One of these two types of ribbons is selected for use.

Figure 4.19 shows the configuration of the ribbon unit.

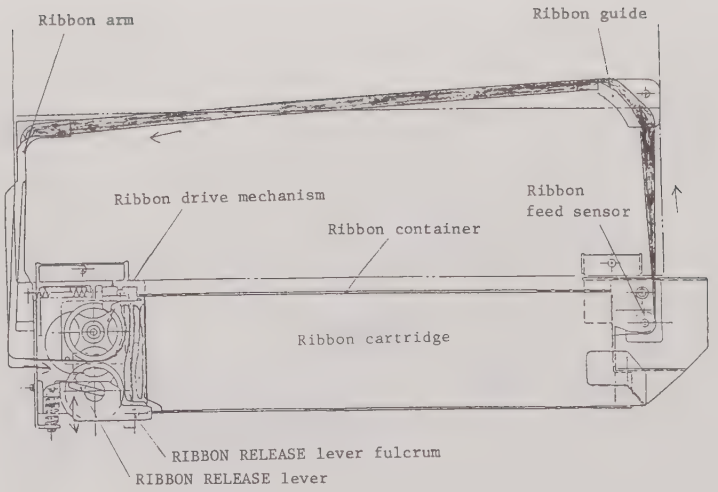


Figure 4.19 Ribbon unit (when using a ribbon cartridge)

The left and right ribbon guides are located so that the ribbon moves obliquely to the print surface and the first to the 136th columns are struck from the lower to the upper edge of the printable ribbon area. See Figure 4.20.

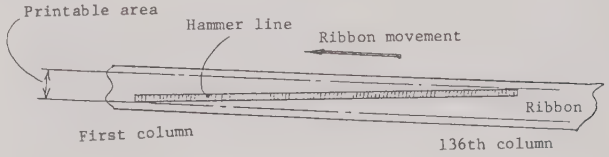


Figure 4.20 Oblique movement of the ribbon

As shown in Figure 4.20, the first hammer strikes the lower part of the ribbon and the 136th hammer strikes the upper part of the ribbon. Usually, the hammers near the first one are used more frequently and the lower part of the ribbon tends to be struck more often. A mechanism that moves the left ribbon guide (ribbon arm) up and down so that all of the ribbon surface is equally struck is available as an option.

In this ribbon container, the ribbon drive side is higher than the ribbon exit side so that the folded ribbon comes out smoothly toward the exit without falling inside the ribbon container or cartridge. Moreover, in the direction of depth, the slide near the exit is higher.

(1) Ribbon drive mechanism

As shown in Figure 4.21, the ribbon drive mechanism consists of two ribbon feed rollers, the ribbon feed motor, and the RIBBON RELEASE lever, and is attached to one frame.

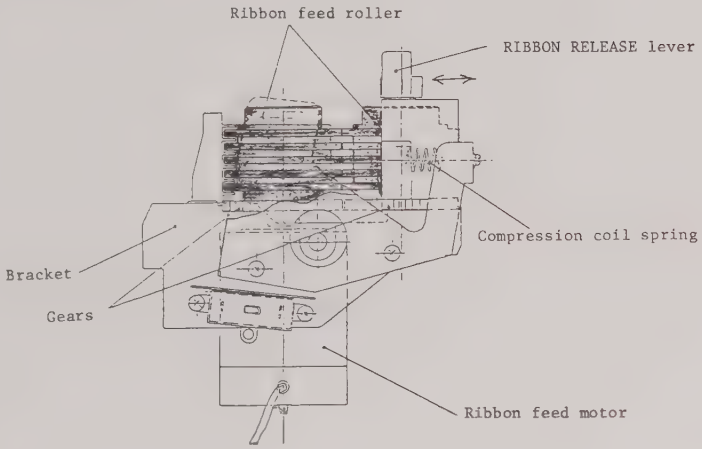


Figure 4.21 Ribbon drive mechanism

One of the ribbon feed rollers is the drive roller connected directly to the ribbon feed motor shaft. The other ribbon feed roller is usually pushed against the drive roller by the compression coil spring. The ribbon is then placed between these two rollers and fed. The gear under the two rollers ensures that they rotate in unison.

The ribbon fed into the ribbon cartridge or ribbon container is folded and stored as shown in Figure 4.19. The ribbon is endless and is always fed in one direction. The stored ribbon is tensioned by the ribbon feed rollers and leaves through the exit of the ribbon container.

If the ribbon is fed as is, it will be too loose. Therefore, a brake mechanism is provided for the ribbon at the exit of the ribbon container. This brake mechanism pushes a plunger against the ribbon to maintain the correct ribbon tension. If the ribbon cartridge is used, the brake mechanism is installed inside the ribbon cartridge. If it is not used, the brake unit attached to the ribbon is installed near the exit of the ribbon container.

As shown in Figure 4.22, the ribbon feed roller that is not connected directly to the motor shaft is provided with a RIBBON RELEASE lever. If this lever is pushed forward, pulling against the compression coil spring, the lever and the roller under it move around the fulcrum and are locked in the open position. In this case, the lever lock parts attached to the roller shaft under the bracket fit into the bracket slot and lock the lever and the roller. In this position, the two rollers are separated and the ribbon can be replaced.

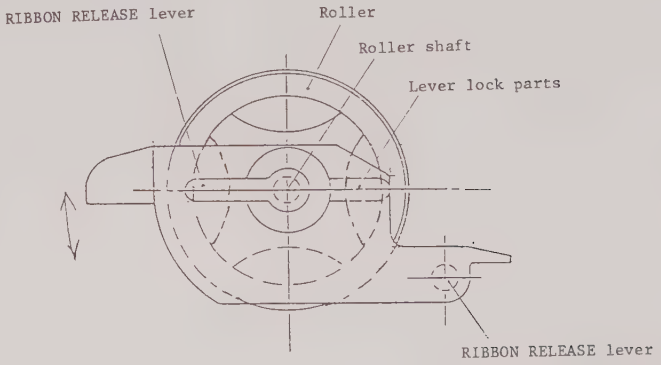


Figure 4.22 RIBBON RELEASE lever

(2) Ribbon feed sensor

The ribbon feed sensor is mounted near the exit of the ribbon and consists of the roller attached to the stepper motor shaft. When the ribbon is fed, the roller rotates by friction with the ribbon and AC voltage is generated in the stepper motor. The ribbon feed state can be checked by monitoring this voltage.

Figure 4.23 shows the ribbon feed sensor.

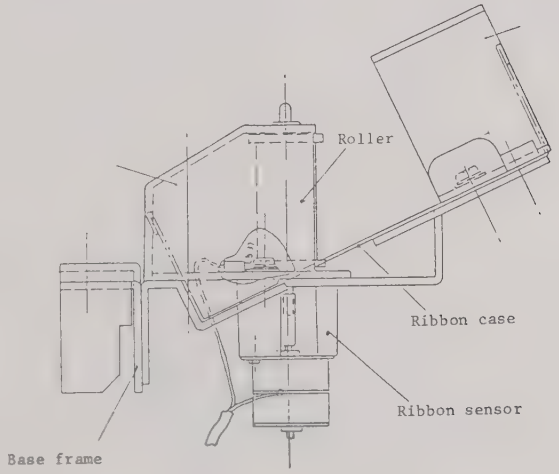


Figure 4.23 Ribbon feed sensor

(3) Ribbon shift assembly (option)

The ribbon assembly is mounted inside the base frame. As shown in Figure 4.24, it consists of the ribbon shift motor (geared motor), the ribbon shift cam mounted on the motor shaft, and the stay attached to the cam.

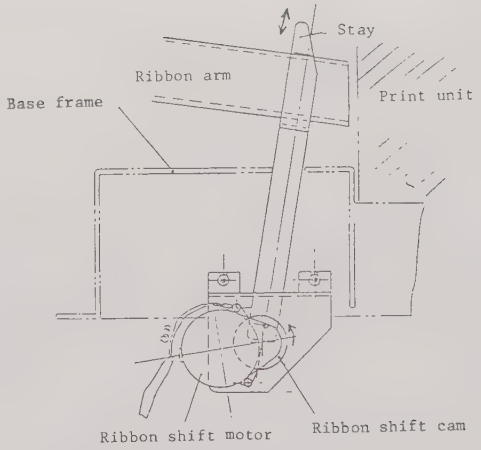


Figure 4.24 Ribbon shift assembly

The drive shaft of the ribbon shift motor completes one rotation every two seconds. One end of the stay is attached to the ribbon shift cam mounted on this drive shaft approximately 10 mm from the ribbon shift cam center. The stay protrudes upward from the slit of the base frame. The stay is guided by this slit and moves up and down with the same cycle as the motor drive shaft. Since the upper end of the stay is attached to the ribbon arm (left ribbon guide), the ribbon arm also moves up and down in the same cycle. Guided by the ribbon arm, the ribbon also moves up and down, and the hammers strike the entire width of the ribbon near the first column.

4.3 Control

The control unit of this printer consists of the interface timing control with the interface driver and receiver, interface control (IFC), device control (DVC), print control circuit, internal buffer (IBF), code ROM, print magnet driver, forms motor driver, and operator panel. Figure 4.25 shows the block diagram of the control unit.

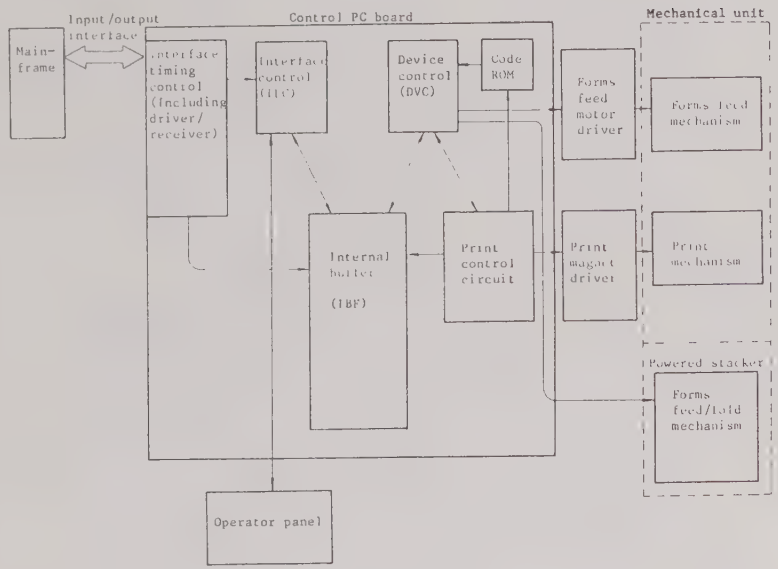


Figure 4.25 Block diagram of the control unit

The sequence of operations of the control unit is as follows:

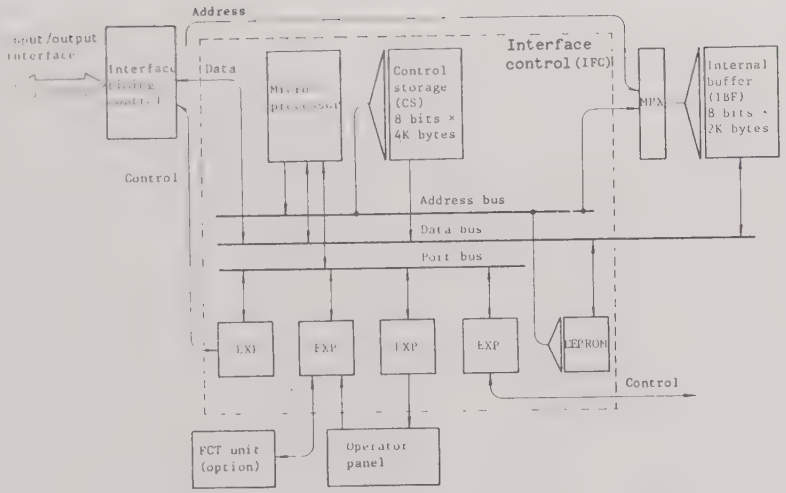
1. Data issued from the mainframe to the I/O interface is stored in the IBF by the interface control. This data consists of a line of print data and the accompanying control code. The control code indicates the print start command and forms feed information.
2. The interface control stores data in the IBF when the control code is transferred, and reports to the IFC that data transfer has terminated.
3. Upon receiving notification that data transfer has terminated, the IFC prepares to initiate printing, decodes the control code received last, changes it to a command code which can operate the DVC, and sets it in the IBF.
4. The DVC reads the command code in the IBF and instructs the print control circuit to start printing.
5. The print control circuit drives the print magnet driver and operates the print mechanism while comparing the line of print data set in the IBF with the code ROM.
6. When printing terminates, the print control circuit reports to the DVC that printing has terminated.
7. Upon receiving notification that printing has terminated, the DVC feeds the form by operating the forms feed mechanism according to the forms feed information indicated by the command code in the IBF.
8. When control of the last line of forms feed is started, the DVC reports to the IFC that feeding of forms has terminated by writing the printer status in the status register in the IBF.
9. Upon receiving notification that feeding of forms has terminated, the IFC instructs the interface timing control to receive the next line of print data.
10. The same sequence of operations is then performed for the next line of print data.

The operations of this printer will be explained by dividing them into interface control, print control, forms feed control and stacker control.

4.3.1 Interface control (IFC)

This section explains control of the I/O interface signals issued by this printer, and control from data transfer to passing of control to the DVC (explained later).

Figure 4.26 shows the block diagram of the IFC mainly for these controls.



MPX: Multiplexer
EXP: Expander
EEPROM: Electrical erasable programmable ROM
FCT: Format control tape

Figure 4.26 Block diagram of the IFC

As shown in Figure 4.26, the IFC consists of a microprocessor, control storage (CS), four expanders, and an EEPROM. They are connected to the microprocessor through an address bus, data bus, and port bus.

The microprocessor handles the operating sequence control of the entire printer, interface control, forms feed format control, operator panel control, test printing, and diagnosis of the printer and microprocessor by using the microprograms stored in CS.

CS consists of an 8-bit 4K-byte ROM, in which the microprograms are stored. The four expanders are ports used when the microprocessor in the IFC exchanges data and signals with IFC external circuits other then those of the IBF. As shown in the figure, expanders are connected to the operator panel and the optional format control tape (FCT) unit in addition to the interface timing controller. Moreover, the control signal line for the DVC, check signal lines from each interlock switch and the EOF sensor, and a line of the check signal generated by the current flowing through the print magnet driver in the non-printing state are connected to the expander.

Because the EEPROM contents can be electrically rewritten and the EEPROM retains its contents when the power is turned off, it is used for setting the functions of this printer. The function set includes 7-bit or 8-bit data transfer mode on the I/O interface, optional transfer data parity check line, and 132 or 136 print columns.

See Chapter 3 for setting details. The contents of the EEPROM are read and written from the operator panel. The operator can therefore use the operator panel to change these settings by rewriting the contents of the EEPROM. In addition to the EEPROM, there is a CE mode-setting circuit set by a jumper plug. However, this setting cannot be changed from the operator panel.

As previously explained, the data transferred to the printer through the I/O interface is stored directly in the IBF. The IBF consists of an 8-bit 2K-byte RAM and includes a print data buffer (PDB), which holds print data for 136 columns, a command area, a status area, and a forms control buffer (FCB) containing forms control data for 255 lines.

Interface control is performed as follows:

1. The printer goes offline after self-diagnosis when power is turned on.
2. When the START/STOP switch of the operator panel is pressed, the switch signal is sent to the microprocessor through the expander.
3. The microprogram checks that the START/STOP switch has been pressed, instructs the DVC to start the print band, checks that the equipment is operating normally, sets the printer online, and prepares for data reception.
4. The microprogram sets the expander and instructs the interface timing control to issue a signal indicating that the printer is ready to receive data.
5. The interface timing control issues a signal indicating that the printer is ready for data reception and issues the data request signal at the same time.
6. Upon receiving the data request signal, the mainframe sends one byte of data to the I/O interface.
7. When the one byte of data is received from the input/output interface, the interface timing control stores it in the PDB of the IBF through the IFC data bus. In this case, the address of the IBF storing the data is specified by the interface timing control as 0.
8. When the interface timing control issues the data transfer request again, one byte of data is transferred and stored in the PDB. In this case, the storage address is 1.

9. After 132 or 136 bytes of data have been transferred, a control code is sent to indicate forms feed information. The control code is also stored in the PDB, following the print data.
10. The interface timing control sends the data transfer termination signal to the microprocessor through the expander and interrupts the microprogram.
11. The microprogram checks that data transfer has terminated, reads the control code in the PDB, converts the code to a command code for the DVC, and stores it in the command area of the IBF. In this case, the control code is stored in any PDB address other than 0. The control code thus indicates to the IFC that printing and forms feed operations are required. If the address is 0, only the forms feed operation is indicated by the control code.
12. The microprogram sends a signal indicating that the DVC has the right to use the IBF; this signal is sent to the DVC through the expander to initiate printing.
13. A signal indicating that forms feed has terminated is issued from the DVC to the microprogram through the expander and a termination interrupt is generated for the microprogram.
14. Recognizing that forms feed has terminated, the microprogram returns control of the IBF to the IFC and checks the status area of the IBF for errors. When the START/STOP switch is pressed during data transfer, printing, or forms feed, or when a signal is received from the interlock switch, the printer is set offline at the time termination of the operation is recognized.
15. If there are no errors and the START/STOP switch is not pressed, the microprogram prepares for data reception, and reexecutes this entire sequence of operations.

The above operation differs slightly depending on the interface used for the data transfer format of the forms feed information.

4.3.2 Print control

This printer controls the print operation, band drive motor, and ribbon feed motor.

(1) Print operation

This section explains control of the print cycle in which one line of print data stored in the PDB is printed. Figure 4.27 shows the block diagram of the print control system.

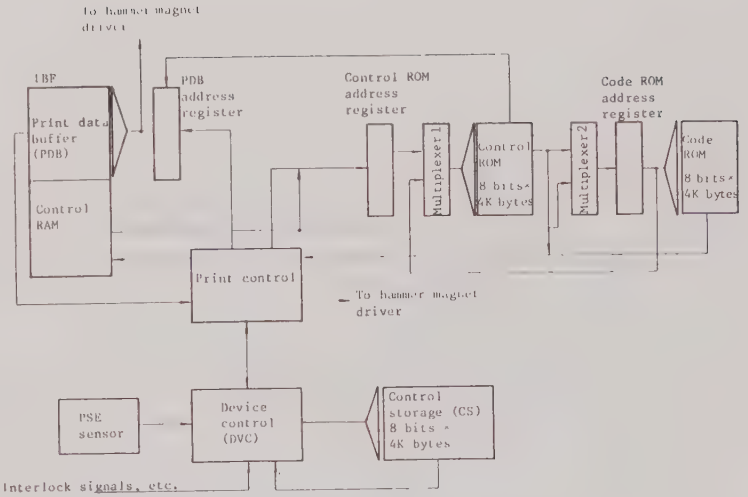


Figure 4.27 Block diagram of the print control system

As shown in Figure 4.27, the print control system consists of the DVC and print control circuit as the central section, the control storage (CS) of the DVC, the PDB area and control RAM area in the IBF, the PDB address register, the control ROM, the control ROM address register, the code ROM, and code ROM address register.

The DVC is an 8-bit microprocessor controlled by the microprogram. It initiates print control, handles forms feed control, monitors each interlock signal from the mechanical unit, and performs self-diagnosis at power-on.

The print control circuit consists of one LSI and controls all print operations.

The CS of the DVC consists of an 8-bit 4K-byte ROM. It stores the microprogram that controls DVC operations.

The PDB area in the IBF has already been explained. The control RAM area in the IBF is a flag area for setting the magnetization timing for the print magnets and indicating the termination of printing for each column.

The PDB address register indicates the access address to the PDB when the PDB is accessed.

The control ROM is an area consisting of an 8-bit 4K-byte ROM. At the time of print control, the value of the PDB address register advances by 5 and the code ROM address register advances by 4.

The control ROM address register indicates the access address when the control ROM is accessed.

The code ROM consists of an 8-bit 4K-byte ROM. It stores all type codes in the same order as the type appears on the print band. Since there are several types of character sets, which differ according to the number of characters, the code ROM stores five types of print band character codes. Because the DVC detects the band being used, the character code used is compared with the contents of the PDB at print control.

The code ROM address register indicates the access address of the code ROM when the code ROM is addressed.

a. Timing signals used for print control

There are 384 pieces of type arranged on the print band. There is one clock mark for each piece of type and one position mark for each character set (see Figure 4.28).

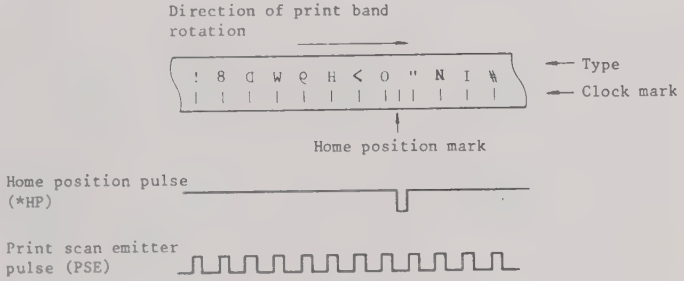


Figure 4.28 Pieces of type and clock mark of the print band

For a 64-character character set, six sets are arranged on the print band, with home position mark for each character set. The PSE sensor detects the home position mark and the clock mark. The detected signal is amplified and converted to a pulse in the DVC. The signals for the home position mark and the clock mark, after being separated into a home position (HP) pulse and a print scan emitter (PSE) pulse, are corrected for changes in voltage, temperature, and fluctuations in the power supply frequency.

The PSE pulse is used as the clock for synchronizing the movement of the print band to control the print timing. The HP pulse is used as the start signal for controlling each character set.

The microprogram of the DVC counts the number of PSE pulses between HP pulses to detect which character set the print band is using.

b. Operation

When control of the IBF is passed from the IFC to the DVC, the DVC microprogram reads the command set in the command area of the IBF and sends the print command signal to the print control circuit, which then initiates print control.

The print control circuit compares the contents of the PDB of all columns with the contents of the code ROM between two successive PSE pulses. If they match, the print control circuit sends a signal to the print magnet driver and activates the hammer corresponding to the column.

Comparison of the PDB contents with the code ROM contents is controlled by dividing the period between two successive PSE pulses into five groups called subscans. Figure 4.29 shows the movement of the print band and the collating sequence of the print data.

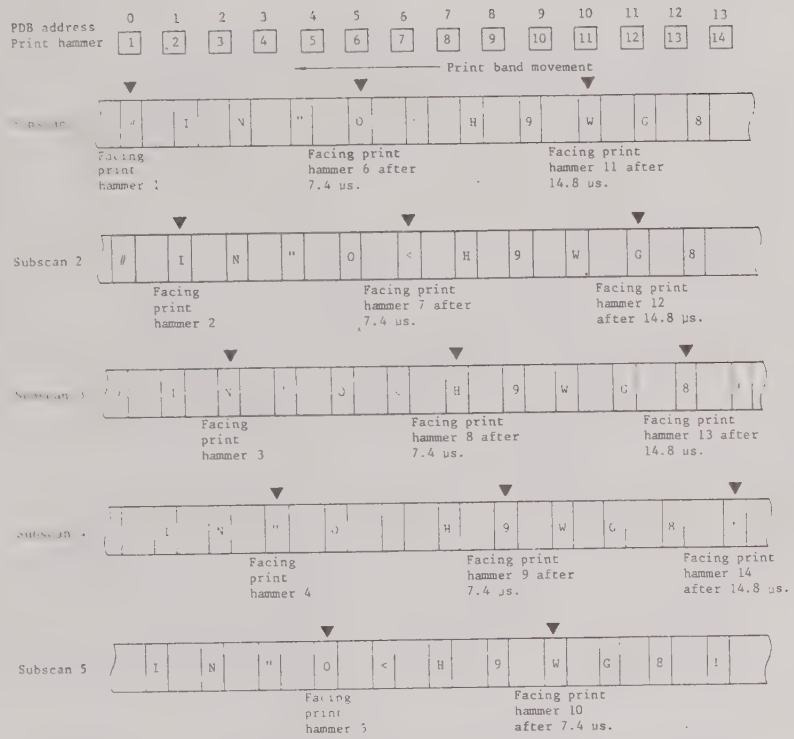

PDB address
Print hammer
0 1 2 3 4 5 6 7 8 9 10 11 12 13
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Print band movement
Facing print hammer 1
Facing print hammer 6 after 7.4 µs.
Facing print hammer 11 after 14.8 µs.
Subscan 2
Facing print hammer 2
Facing print hammer 7 after 7.4 µs.
Facing print hammer 12 after 14.8 µs.
Facing print hammer 3
Facing print hammer 8 after 7.4 µs.
Facing print hammer 13 after 14.8 µs.
Facing print hammer 4
Facing print hammer 9 after 7.4 µs.
Facing print hammer 14 after 14.8 µs.
Subscan 5
Facing print hammer 5
Facing print hammer 10 after 7.4 µs.

Figure 4.29 Print band movement and collation of print data (M3040/M3041)

When the print cycle begins, subscan 1 is executed first. In subscan 1, the code of address 0 in the PDB, i.e., the character for the first column, is collated, as shown in Figure 4.29, with the ROM code whose address is specified by the code ROM address register. This indicates the type on the print band facing print hammer 1. If the codes match, the drive signal for hammer 1 is issued. Then, the character at the sixth column is collated. The PDB address register is incremented by five and the code RAM address register is incremented by four. This collation is executed 7.4 seconds after the first collation for M3040/M3041. By rotation of the print band, the fourth character from the character facing the first column faces the hammer at the sixth column. In the same way, the 11th, 16th, ..., 136th characters are collated at 7.4 second intervals and the hammers at the matching columns are activated for printing.

The second subscan is then initiated. At this stage, the characters at the 2nd, 7th, 12th, and 132nd columns are collated.

The five subscans are repeated for each PSE until all characters at 136 (or 132) columns are matched by collation and printed. In this way, one line is printed.

The time from the start of subscan 1 to that of each subscan is precisely set. Therefore, the facing column and the type on the print band are also determined at the start of each subscan and control is the same as in subscan 1.

The collation performed at these subscans is next explained using a circuit operation as an example. Control is performed as follows:

1. The code ROM address register is incremented by 1 for each PSE pulse, except during the print cycle, and indicates the byte address of the code ROM in which the type code on the print band facing the print hammer at the first column is stored.
2. After entering the print cycle, the contents of the code ROM register are incremented by 1 for the PSE output first, and the first collation of subscan 1 is performed according to the contents of the code ROM address register. After the first collation, this code ROM address register is managed by the print control circuit.
3. The character code stored in the code ROM address indicated by the code ROM address register is input in the print control circuit. PDB address 0 is accessed and the data (print data for the first column) is input to the print control circuit.

4. The output of the PDB and that of the code ROM are collated in the print control circuit. If they match, the excitation signal for the print magnet at the first column is sent to the print magnet driver.
5. The contents of accessed PDB address 0 are set in the PDB address register.
6. Multiplexer 1 selects a signal from the control ROM address register and accesses the address of the control ROM indicated by the control ROM address register.
7. Because each byte of the PDB address area of the control ROM contains the value of the address plus 5, the PDB address data of the previously accessed PDB address data plus 5. i.e., address 5, is set in the PDB address register by the timing signal from the print control circuit.
8. The PDB address indicated by the PDB address register, i.e., the print data of the sixth column, is input to the print control circuit.
9. Multiplexer 1 selects a signal from the code ROM address register to access the control ROM address indicated by the code ROM address register.
10. Because each byte of the code ROM area of the control ROM accessed by the code ROM address register contains its byte address plus 4, the output is the code ROM address data of the previously accessed code ROM address plus 4. It is set in the ROM address register through multiplexer 2.
11. The code ROM address data indicated by the code ROM address register, i.e., the character code on the print band facing the sixth column, is input to the print control circuit.
12. The print control circuit performs collation again and the above operation is performed in the same way for characters of the 11th, 16th, ..., 136th columns. The control RAM area in the IBF has a flag area for 136 columns. A flag is set for columns for which printing has been completed. In this way, printed columns are identified.
13. When entering subscan 2 control, the PDB address of the PDB address (at the start of subscan 1) plus 1, i.e., address 1 and the code ROM address of the code ROM address (at the start of subscan 1) plus 1 are accessed to execute data collation.
14. The same control is performed until subscan 5. If all columns are not collated, subscan 1 is restarted at the leading edge of the next PSE pulse. In this case, the PDB address is started from 1, while the code ROM address plus 1 at the start of the previous subscan 1 is accessed as the code ROM access.

c. Print magnet energizing

The print magnet excitation signal set during each subscan is reset after a specific time. If t is the time from the leading edge of the PSE pulse to that of the next one, the length is t for M3040 and M3041, and 2t for M3042.

(2) Band drive motor control

The band drive motor is stopped when the printer is set offline. It starts when the START/STOP switch is pressed in TEST mode to specify test print. It also starts when the printer is set online.

The microprogram of the IFC always monitors the operator panel. If the START/STOP switch is pressed in NORMAL mode offline state, the printer is set online and the start command of the band drive motor is set in the command area in the IBF. Reading this command, the DVC sends the Belt Go signal to the solid state relay mounted in the power control unit. The solid state relay circuit is closed and AC power is supplied to the band drive motor to start it. The same procedure is done at test print.

The print control circuit monitors PSE pulse intervals after the band drive motor is started, in order to check the speed of the band drive motor. If the motor does not arrive at the rated speed within one or two seconds after starting, an error signal is sent to the DVC. If the motor speed becomes slower by 15% than the rated speed during online printing, an error signal is also sent to the DVC. As soon as this error signal is received, the band drive motor is stopped by turning the Belt Go signal off.

If a command, such as forms feed, is not sent to the I/O interface in the online state for 30 seconds, the command is not set in the IBF. The DVC recognizes that no command has been sent and turns the Belt Go signal off and stops the band drive motor. When the print command arrives after stopping the band drive motor, the DVC restarts it.

(3) Ribbon feed motor control

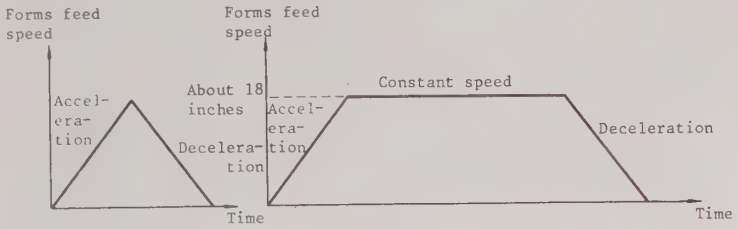
The ribbon feed motor starts with the band drive motor. If commands, such as print and forms feed, are not sent to the I/O interface for 500 ms, the command is not set in the IBF. The DVC recognizes that no command has been sent and stops the ribbon feed motor.

4.3.3 Forms feed control

In the forms feed cycle, this printer controls forms feed by the control code or by the forms feed data transferred along the I/O interface.

The forms feed motor is a stepper motor. The drive shaft is held in place by applying less current to each coil of the forms feed motor than at the time of driving. The same current flows during printing and forms feeding and prevents the forms from shifting by firmly locking the drive shaft.

When the forms feed command is set in the IBF, the DVC microprogram reads it and executes a forms feed by switching the excitation to each phase. Figure 4.30 shows the relationship between the forms feed speed when feeding one line and when feeding several lines.



(1) One-line feed (2) More than one line feed

Figure 4.30 Forms feed drive shaft speed

When forms feed is terminated, the drive shaft is locked again.

If an error occurs during forms feed, the DVC microprogram sets the error status in the status area of the IBF, reports it to the IFC microprogram, then stops.

See the Appendix for details on the transfer of forms feed information through the I/O interface.

4.4 Power Supply

The AC power of this printer is supplied through a noise filter and circuit breaker. By changing the input tap of the transformer, several voltage inputs can be set.

Figure 4.31 shows the power supply system.

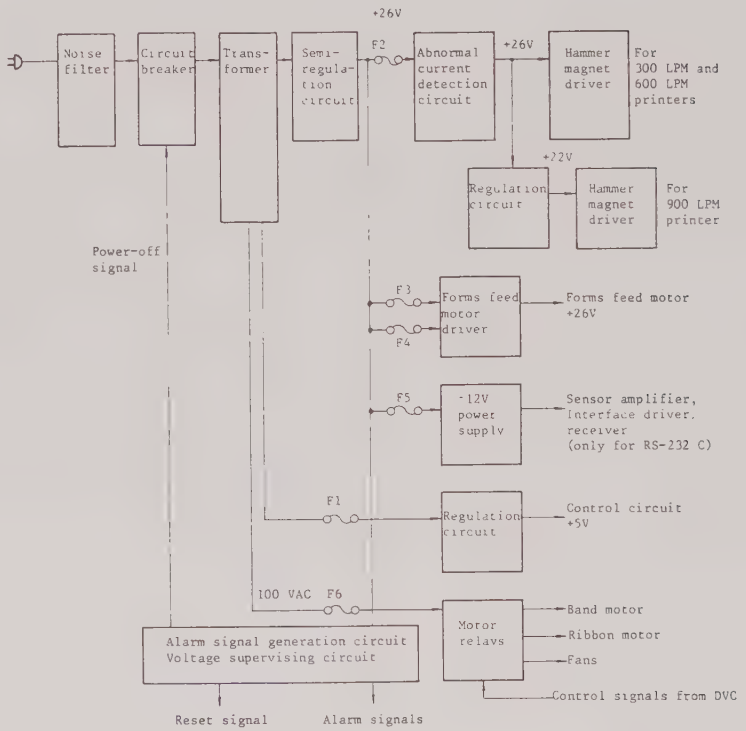


Figure 4.31 Power supply system

As shown in Figure 4.31, the voltage output of the power supply includes +26 V, +22 V, +5 V, +12 V, -12 V, and 100 VAC.

The +26 V is used to drive the paper advance mechanism and the hammer magnet in the M3040 and M3041 printers. For the M3042 printer, the +26 V used to drive the hammer magnet is reduced to +22 V by a voltage regulator. The current is supplied to the hammer magnet driver through the abnormal current detection circuit to protect against overcurrent.

The regulated power for the control circuit of this printer is +5 V.

The power supply for the amplifier circuit of the PSE sensor output is +12 V. It is also the power for the interface driver/receiver for the RS-232C I/O interface.

The power for the interface driver/receiver is -12 V when RS-232C is used.

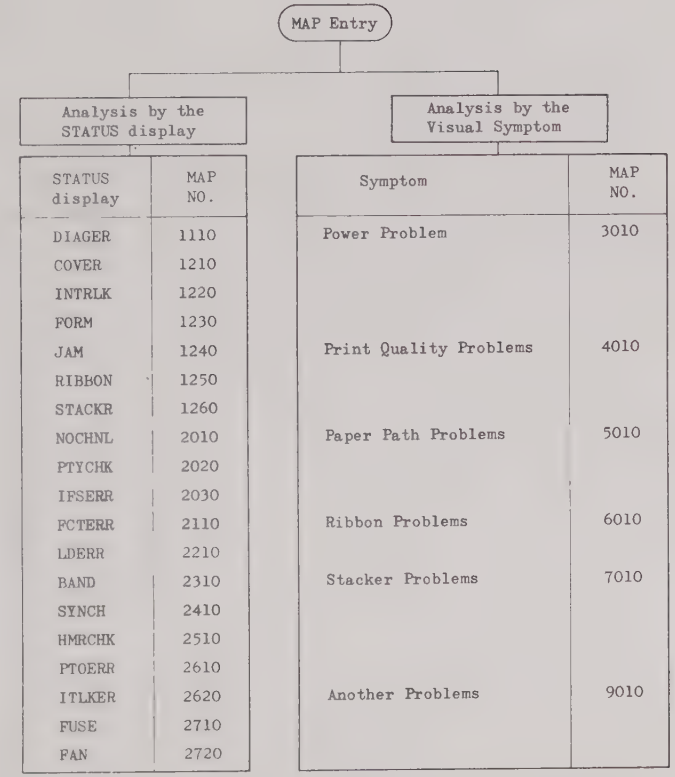
The band drive motor, ribbon feed motor, and fans are supplied with 100 VAC. These power supplies are turned on and off by signals from the control circuit.

When the power of this printer is turned on, each supply voltage arrives at the rated voltage after a specific time according to the characteristics of the power supply circuits. The +5 V arrives first at the rated value, and then the +26 V and +12 V. The voltage monitor circuit of this printer supervises these voltages. If they do not arrive at their respective rated values, the reset signal is issued to the control circuit to prevent the circuit from operating abnormally.

When a fuse blows or a fan alarm is detected, this power supply sends an alarm signal to the control circuit.

CHAPTER 5 MAINTENANCE ANALYSIS PROCEDURE (MAP)

This chapter lists various faults which may be detected and possible solutions.



STATUS display	MAP NO.
DIAGER	1110
COVER	1210
INTRLK	1220
FORM	1230
JAM	1240
RIBBON	1250
STACKR	1260
NOCHNL	2010
PTYCHK	2020
IFSERR	2030
FCTERR	2110
LDERR	2210
BAND	2310
SYNCH	2410
HMRCHK	2510
PTOERR	2610
ITLKER	2620
FUSE	2710
FAN	2720

Symptom	MAP NO.
Power Problem	3010
Print Quality Problems	4010
Paper Path Problems	5010
Ribbon Problems	6010
Stacker Problems	7010
Another Problems	9010

MAP No.	Symptom	Troubleshooting Item No.	Troubleshooting	Judgement	Possible failure	GO TO No. MAP NO.	GO TO No. REP NO.	GO TO No. TEST NO.	Note
1110-1	DIAGER (Diagnostic Error)	1	An error was detected during initial diagnosis. Press the FINE FORMS ADJUST switch (↑ or ↓) to check if the error code is 40, 41, 42, or 43.	YES	Replace the control circuit PC board.		6050		
				NO	Proceed to item 2.				
		2	Is the error code 44?	YES	Proceed to item 3.				
				NO	Proceed to item 7.				
		3	Turn off the power, remove connectors CNP2 and CNP3 from the magnet driver (HDDMU), and turn on the power again. DIAGER will be detected again. Is the error code 44?	YES	Replace the control circuit PC board.		6050		
				NO	Proceed to item 5.				
		4	Replace the control circuit PC board. Turn on the power again. Is the error code 44?	YES	Replace the power unit.		6020		
				NO	END				
		5	Turn off the power, connect CNP2 and CNP3 to the magnet driver, remove connectors CNA through CNH from the magnet driver, and turn on the power again. DIAGER will be detected again. Is the error code 44?	YES	Replace the magnet driver PC board.		6060		
				NO	A hammer magnet coil is short-circuited to FG. Proceed to item 6.				
		6	Connect CNA through CNH to the magnet driver one by one and turn the power on and off each time, locate the magnet unit where a coil is short-circuited to FG, and replace the magnet unit.	END			3020		
		7	Is the error code 45?	YES	Replace the magnet driver PC board. Proceed to item 8.		6060		
				NO	Proceed to item 9.				
		8	Turn on the power. Is the error code 45?	YES	Replace the control circuit PC board.		6050		
				NO	END				

MM NO. 1110-1

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
1110-2	DIAGER (Diagnostic Error)	9	46␣xxx (xxx: column number) Turn off the power. Ensure that the following connectors are correctly connected and turn on the power again. Does the error occur again? - CNJ16 (Control circuit PC board) - CNJ1 (Magnet driver PC board) - CNA through CNH (Magnets)	YES	The coil for the column indicated by xxx is disconnected. Replace the hammer magnet assembly. See Fig. 6.34 (REP 3020-2) for the relationship between columns and units.		3020		
				NO	END				

MM NO.	1110-2

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
1210	COVER (Cover Open)	1	Close the top cover tightly. Does the display go out?	YES	END				
				NO	Proceed to item 2.				
		2	Is the top cover interlock normal?	YES	Replace the control circuit PC board.		6050		
				NO	Replace the top cover interlock switch.		6120		

MM NO.	1210

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
1110-2	DIAGER (Diagnostic Error)	9	46␣xxx (xxx: column number) Turn off the power. Ensure that the following connectors are correctly connected and turn on the power again. Does the error occur again? - CNJ16 (Control circuit PC board) - CNJ1 (Magnet driver PC board) - CNA through CNH (Magnets)	YES	The coil for the column indicated by xxx is disconnected. Replace the hammer magnet assembly. See Fig. 6.34 (REP 3020-2) for the relationship between columns and units.		3020		
				NO	END				

MM NO.	1110-2

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judge-ment		MAP NO.	REP NO.	TEST NO.	
1210	COVER (Cover Open)	1	Close the top cover tightly. Does the display go out?	YES	END				
				NO	Proceed to item 2.				
		2	Is the top cover interlock normal?	YES	Replace the control circuit PC board.		6050		
				NO	Replace the top cover interlock switch.		6120		

MM NO.	1210

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
1220	INTRLK (THROAT OPEN lever or BAND COVER latch are open)	1	Tightly secure the THROAT OPEN lever. Does the display go out?	YES	END				
				NO	Proceed to item 2.				
		2	Tightly secure the BAND COVER latch. Does the display go out?	YES	END				
				NO	Proceed to item 3.				
		3	Has the BAND COVER latch beer torn out or damaged?	YES	Replace the BAND COVER.		2160		
				NO	Proceed to item 4.				
		4	Is the BAND COVER interlock switch normal? Are the connectors connected correctly to the switch terminals?	YES	Proceed to item 5.				
				NO	Replace the BAND COVER interlock switch.		2150		
		5	Is the THROAT OPEN lever interlock switch normal? Are the connectors connected correctly to the switch terminals?	YES	Replace the control circuit PC board.		6050		
				NO	Replace the THROAT OPEN lever interlock switch.		2140		

MM NO.	1220

MAP No.	Description	Troubleshooting Item No.	Troubleshooting	Judgement	Possible failure	GO TO No. MAP NO.	GO TO No. REP NO.	GO TO No. TEST NO.	Note
1230	FORM	1	Open the front door, and see if there are any forms in the forms hopper.	YES	Add new paper.				
				NO	Proceed to item 2.				
		2	Is the EOF switch normal?	YES	Replace the control circuit PC board.		6050		
				NO	Adjust the EOF switch position or replace the EOF switch assembly.	5010			

MM NO.	1230

MAP No.	Symptom	Troubleshooting Item No.	Troubleshooting	Judgement	Possible failure	GO TO No. MAP NO.	GO TO No. REP NO.	GO TO No. TEST NO.	Note
1240-1	JAM (Paper jammed or torn)	1	Is the paper really jammed or torn?	YES	Proceed to item 7.				
				NO	Proceed to item 2.				
		2	Are CNP35, CNJ36, and CNP31 connected?	YES	Proceed to item 3.				
				NO	Connect them.		4010, 4060		
		3	Is the tension in the paper feed motor timing belt normal?	YES	Proceed to item 4.				
				NO	Adjust the tension in the timing belt.		4020		
		4	Feed paper in FDTST test mode. Is the feed sensor output signal normal? See REP 4070.	NO	Adjust the paper feed sensor. Proceed to item 5.		4070		
				YES	Replace the control circuit PC board.		6050		
		5	Does the error occur again?	YES	Replace the paper feed sensor and adjust it.		4080		
				NO	END				
		6	Does the error occur again?	YES	Replace the control circuit PC board.		6050		
				NO	END				
		7	Is the FORM THICKNESS knob correctly set for the paper width?	YES	Paper path	5010			
				NO	Adjust the position of the FORM THICKNESS knob.				

MM NO.	1240-1

MAI No.	Symptom	Troubleshooting Item No.	Troubleshooting	Judgement	Possible failure	GO TO No. MAP NO.	GO TO No. REP NO.	GO TO No. TEST NO.	Note
1250	RIBBON	1	Has the ribbon been properly inserted? Is the ribbon loose?	YES	Proceed to item 2.				
				NO	Properly insert the ribbon and/or remove any slack.		5020		
		2	Is the ribbon heavily damaged?	YES	Replace the ribbon.		5020		
				NO	Proceed to item 3.				
		3	Are CNP34 and CNP42 connected?	YES	Proceed to item 4.				
				NO	Connect them.		5010		
		4	Advance the ribbon in test mode RBNTST. Is the ribbon feed sensor output normal?	YES	Replace the control circuit PC board.		6050		
				NO		6010			

MM NO.	1250

MAP No.	Symptom	Troubleshooting Item No.		Judgement	Possible failure	GO TO No. MAP NO.	REP NO.	TEST NO.	Note
2010	NOCHNL	1	FCB does not contain the channel specified in the SKIP command received from the mainframe (see APPENDIX B, B.4.3). Is FCB data loaded or is FCT read before job execution?	YES	FCB data or FCT data does not contain the channel specified in the SKIP command. Check the FCB data, FCT tape, and the channel specified in the SKIP command, re-load FCB data, and retry the job. Proceed to item 2.				
				NO	Proceed to item 5.				
		2	Does NOCHL occur again?	YES	Proceed to item 3.				
				NO	END				
		3	Is FCT used?	YES	Replace the FCT unit, re-load the FCT tape, and retry the job. Proceed to item 4.		6130		
				NO	Check the output voltage. Proceed to item 6.		6010		
		4	Does NOCHL occur again?	YES	Check the output voltage. Proceed to item 6.		6010		
				NO	END				
		5	Was the last command issued from the mainframe a SKIP command?	YES	FCB data or FCT tape has not been loaded. Load one of them.				
				NO	Check the output voltage. Proceed to item 6.		6010		
		6	Is the output voltage normal?	YES	Replace the control circuit PC board.		6050		
				NO	Adjust the output voltage.		6010		

MM NO.	2010

MAP No.	Symptom	Troubleshooting Item No.	Troubleshooting	Judgement	Possible failure	GO TO No. MAP NO.	GO TO No. REP NO.	GO TO No. TEST NO.	Note
2020	PTYCHK (Parity Check)	1	Was the data parity check for the mainframe performed correctly? - EVEN/ODD parity - Data bit WIF 1 to 8, P/WIF 1 to 7, P, PI - Interface signal high/low	NO	Match the data parity check with the mainframe in SET UP mode.				See section 3.3.4
				YES	Proceed to item 2.				
		2	Are the interface connectors correctly connected? Is CNP 14 correctly connected to the control circuit PC board?	YES	Check the output voltage. Proceed to item 6 of MAP 2010.	Item 6 or 2010	6010		
				NO	Connect them and conduct the online test again.				

MM NO.	2020

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
2030	IFSERR (Interface Signal High/Low Error)	1	Is the logic of the input/output Interface signal (high/low) identical to that of the mainframe?	YES	Proceed to item 2 of MAP 2020 (PTYCHK).	2020			
				NO	Match them in SET UP mode.				

MM NO.	2030

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
2110	FCTERR	1	Press the FINE FORMS ADJUST switch (↑ or ↓) on the operator panel to check the details of the error displayed.	12	FCT read error or punch error	2120			
				13	FCT too long	2130			
				14	FCT too short	2140			
				15	FCT control error	2150			
				16	Channel 1 non detect	2130			

MM NO.	2110

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
2120	FCTERR - 12 (FCT read error or punch error)	1	Check the FCT tape for the following: - Are holes punched correctly? - When one FCT tape contains several sets of format data for the same page format, are they identical?	YES	Proceed to item 2.				
				NO	Correctly modify the FCT tape and reload it.				
		2	Are CNP22, CNP21 (see REP 6130) and CNP13 (see REP 6050) correctly connected?	YES	Replace the FCT unit. Proceed to item 3.		6130		
				NO	Correctly connect them and reload the FCT tape.				
		3	Reload the FCT tape. Did the error occur again?	YES	Check the output voltage. Proceed to item 6 of MAP 2010.	Item 6 or 2010	6010		
				NO	END				

MM NO.	2120

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
2130	FCTERR - 13 FCTERR - 16 (·FCT too long) (·Channel 1 non detect)	1	Check the FCT tape for the following: - Are there no more than 255 lines on a page? - Is channel 1 punched?	YES	Proceed to item 2 of MAP 2120.	2120			
				NO	Repunch and reload the FCT tape.				

MM NO.	2130

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judge-ment		MAP NO.	REP NO.	TEST NO.	
2140	FCTERR - 14 (FCT too short)	1	Check the FCT tape for the following:	YES	Repunch and reload the FCT tape.				
			- Is channel 1 punched continuously?	NO	Proceed to item 2 of MAP 2120.	2120			

MM NO.	2140

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
2150	FCT Control Error	1	Is the FCT tape set in the FCT unit?	YES	Proceed to item 2.				
				NO	Insert the FCT tape.				
		2	Has the FCT tape jammed in the FCT unit?	YES	Remove the FCT tape and repunch it.				
				NO	Proceed to item 2 of MAP 2120.	2120			

MM NO.	2150

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
2210	LDERR (FCB Load Error)	1	Press the FINE FORMS ADJUST switch (↑ or ↓) on the operator panel to check the details of the error displayed.	17	FCB load data indicates that the specified number of lines on a page is 1 or none.	2220			
				18	FCB load data indicates that the specified number of lines on a page is 255 or greater.	2220			
				19	The number of FCB load data items is odd or the position of the STOP code (X'6E') is incorrect.	2220			

MM NO.	2210

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
2220	LDERR - 17 LDERR - 18 LDERR - 19	1	Check the FCB load data. (See Appendix B.4.2.)	YES	Check the output voltage. Proceed to item 6 of MAP 2010.	Item 6 of 2010	6010		
				NO	Correctly modify the FCB data and reload it.				

MM NO.	2220

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judge-ment		MAP NO.	REP NO.	TEST NO.	
2310	BAND		Error code 20 Band Speed Check			2320			
			Error code 21 Band Start Check			2330			
			Error code 22 HD Non detect			2330			
			Error code 23 PSE Non detect			2330			
			Error code 24 PSE/HP Incorrect detect			2330			
			Error code 25 Option Code ROM not installed		Special band data is not written in the code ROM. Replace the code ROM.				
			Error code 26 Band Speed Check			2320			

MM NO.	2310

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
2320	Error code 20 (Band Speed Check)	1	Has the ink ribbon returned to the type band?	YES	The ink ribbon has been used up or is defective. → Replace it.	6010			
				NO	Proceed to item 2.				
		2	Does the band pulley (drive or idler) rotate smoothly?	NO	1. The pulley is dirty. → Clean it. 2. The band or platen is dirty. → Clean it.		1211 1212 1211 1215		
				YES	Proceed to item 3.				
		3	Are there any problems with the motor or V belt? 1 Belt tension 2 Torn belt, etc.	YES	Replace the motor or belt.		2070 2100		
				NO	Proceed to item 4.				
		4	Has the belt shifted in the vertical direction?	YES	Adjust the vertical position of the band.		2030		
				NO	Proceed to item 5.				
		5	Do the AC line frequency and motor pulley match?	YES	Proceed to item 6.		2070		
				NO	Replace the pulley.				
		6	Is PSE output abnormal?	YES	1) The PSE sensor is not correctly mounted. 2) The PSE sensor is defective. 3) *PSWIND and PSEM are not correctly adjusted. 4) The control PC board is defective.		 2060 2051 6050		
				NO					

MM NO.	2320

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
2330	Error code 21 (Band Start Check)	1	Is a print band installed?	YES	Proceed to item 2.				
				NO	Install a print band.		2030		
		2	Was the print band installed backwards?	YES	Install it correctly.		2030		
				NO	Proceed to item 3.				
		3	Does the band rotate when the START/STOP switch is pressed during the SFTPRT test in TEST mode?	YES	Proceed to item 4.				
				NO		2320			
		4	Is the vertical position of the print band correct?	YES		2320			
				NO	Correct the adjustment.		2030		

MM NO.	2330

TEST No.	Symptom	Troubleshooting Item No.	Troubleshooting	Judgement	Possible failure	GO TO No. MAP NO.	GO TO No. REP NO.	GO TO No. TEST NO.	Note
2410	SYNCH	1	Does the error occur again when the SFTPRT test is conducted in TEST mode?	YES	PSE output has not stabilized. (The troubleshooting procedure is the same as for a band speed check.)	2320			
				NO	1) The PSE signal was incorrectly detected due to noise. 2) The lead PSE wire is loose.		2050		

MM NO.	2410

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
2510	Hammer Check	1	Conduct the SFTPRT test in TEST mode to see if the hammer check occurs again.	YES	Proceed to item 2.				
				NO	1) A wire in the device is loose. 2) A malfunction occurred due to noise. 3) The PSE sensor is loose.		2050		
			Error code 38: Coil protect Current flow through the print magnet is abnormal.			2520			
		2	Error code 36 xxx: Hammer misfire (xxx: column number) The magnet of a column xxx in which no printing is specified is on.			2530			
			Error code 38 xxx: Hammer failure (xxx: column number) The magnet of a column xxx in which printing is specified is off.			2530			

MM NO.	2510

MAP No.	Symptom	Troubleshooting Item No.	Troubleshooting	Troubleshooting Judgement	Possible failure	GO TO No. MAP NO.	GO TO No. REP NO.	GO TO No. TEST NO.	Note
2520	Error code 38 (Coil Protect)	1	Press the FORMS ADVANCE switch to check the details of the error. Is the error code 36␣xxx or 37␣xxx (xxx: column number)?	YES	Error with error code 36 or 37	2530			
				NO	Proceed to item 2.				
		2	Press the ERROR RESET switch to see if the error is reset.	YES	Error with error code 36 or 37	2530			
				NO	1) A hammer magnet coil or lead wire has contacted the frame.		3020		
					2) The magnet driver PC board is defective.		6060		
					3) The wiring between the power unit and magnet driver is incorrect.				
					4) The stabilization circuit PC board (VPBM) in the power unit is defective.		6030		
					5) The power unit is defective.		6020		

MM NO.	2520

MAP No.	Symptom	Troubleshooting Item No.	Troubleshooting	Troubleshooting Judgement	Possible failure	GO TO No. MAP NO.	GO TO No. REP NO.	GO TO No. TEST NO.	Note
2610	PTOERR (Print Time-Out Error)	1	Is the DC power voltage normal?	YES	Proceed to item 2.				
				NO	1) Output voltage of the power unit is abnormal.		6010		
					2) The power unit is defective.		6020		
		2	Is the PSE output normal (See REP 2050)?	YES	Proceed to item 3.				
				NO	1) The PSE sensor gap is incorrect.		2060		
					2) The PSE sensor is defective.		2060		
					3) The print band is defective.		2030		
					4) The control PC board is defective.		6050		
		3	Is the timing between *PSWIND and PSEM correct? See REP 6050.	YES	The control PC board is defective.		6050		
				NO	Correct the timing.		2050		

MM NO.	2610

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
2530	Error code 36␣xxx Error code 37␣xxx (xxx: column where error occurred)	1	Is the resistance of the hammer magnet for the column indicated by xxx approximately 3.0Ω?	NO	Replace the hammer block for the indicated column.		3020		
				YES	1) The magnet drive PC board is defective.		6060		
					2) The control PC board is defective.		6050		
					3) The hammer magnet lead wire has contacted the frame.		3020		
					4) The cable between the control PC board and magnet driver PC board is defective.				

MM NO.	2530

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judge-ment		MAP NO.	REP NO.	TEST NO.	
2620	ITLKER (Interlock Drop in Printing)	1	The THROAT OPEN lever or BAND COVER latch was removed while printing.		Check the THROAT OPEN lever or BAND COVER latch.	1220			

MM NO.	2620

MAP No.	Symptom	Troubleshooting Item No.	Troubleshooting	Troubleshooting Judgement	Possible failure	GO TO No. MAP NO.	GO TO No. REP NO.	GO TO No. TEST NO.	Note
2710	FUSE (Fuse Alarm)	1	Is fuse F2, F3, F4, or F5 in the power unit blown?	YES	1) F2 (VD: Magnet drive voltage) 2) F3, F4 (Feed) 3) F5 (+12V)	Proceed to item 2.			
				NO	Replace the control PC board.		6050		
		2	Replace the blown fuse and turn on the power again. Does the fuse blow again?	YES	1) For F2 (VD: Magnet drive voltage), - The magnet driver PC board is defective. - The hammer magnet has fallen into the frame. - The power unit is defective. - The wire between the power unit and magnet driver PC board has a short circuit.		6060 3020 6020		
				NO	The fuse was deteriorated.				

MM NO.	2710

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judge-ment		MAP NO.	REP NO.	TEST NO.	
2720	FAN (Fan Alarm)	1	FAN2 for the power unit is defective.		Replace the power unit.	6020			

MM NO.	2720

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
3010	Power Problems	1	Power cannot be turned on. All of the lamps on the operator panel do not light and STATUS is not displayed.			3020			
		2	Operator panel lamps remain on.			3030			
		3	Power goes off a few minutes after it is turned on.			3040			
		4	FUSE is displayed on the operator panel.			2710			
		5	FAN is displayed on the operator panel.			2720			

MM NO.	3010

MAP No.	Symptom	Troubleshooting Item No.	Troubleshooting	Troubleshooting Judgement	Possible failure	GO TO No. MAP NO.	GO TO No. REP NO.	GO TO No. TEST NO.	Note
3020	Power cannot be turned on. (The operator panel lamps do not light.)	1	Does the POWER ON switch return to O immediately after it is pushed to 1?	YES	Proceed to item 2.				
				NO	1) The AC input cable is not connected.				
					2) The AC cable is not conducting the AC input voltage.				
					3) Connector CNJ11 has been removed from the power unit.		6020		
					4) The power transformer terminals have been removed.		6040		
					5) The POWER ON switch (NFB) is defective.				
					6) Operator panel cables are not connected.		6070		
		2	Is fuse F1 (+5V) in the power unit blown?	YES	1) F1 is blown.		6020		
					2) +5V has a short circuit. Locate the short circuit.				
					3) +5V over voltage		6020 6010		
				NO	F6 fusing (100 VAC)				
					1) F6 is blown.		6020		
					2) The band motor is defective.		2070		
					3) The ribbon motor is abnormal.		5040		
					4) FAN1 is defective.		6080		
					5) FAN2 of the power unit is defective. (Replace the power unit.)		6020		

MM NO.	3020

MAL No.	Symptom	Troubleshooting: Item No.	Troubleshooting	Troubleshooting: Judgement	Possible failure	GO TO No.: MAP NO.	GO TO No.: REP NO.	GO TO No.: TEST NO.	Note
3030	Operator panel lamps remain on.	1	Is the AC input voltage identical to that specified for the power transformer?	YES	1) The output voltage is abnormal.		6010		
					2) The power unit is defective.		6020		
					3) The control PC board is defective.		6050		
					4) The operator panel is defective.		6070		
				NO	Match the AC input voltage with that of the transformer.		6040		

MM NO.	3030

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judge-ment		MAP NO.	REP NO.	TEST NO.	
3040	Power goes off a few minutes after it is turned on.		Is FAN1 CNP65 connected?	YES	1) FAN1 is defective 2) The air intake is clogged with dust.		6080		
				NO	Connect it.		6080		

MM NO.	3040

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
4010	Print Quality Problems (without Error Status)	1	Print density at the upper part of characters differs from that in the lower part, or the upper parts or lower parts of characters are missing.			4020			
		2	Character position shifts horizontally or the left or right parts of characters are missing.			4030			
		3	Print density varies.			4040			
		4	Double printing or ghost printing occurs.			4050			
		5	Characters are omitted.			4060			
		6	Ribbon smudges appear on the paper.			4070			
		7	Character position shifts vertically.			5030			

MM NO.	4010

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judge-ment		MAP NO.	REP NO.	TEST NO.	
4020	The print density is different in the upper and lower parts of characters.	1	Do all characters or all columns have the same problem?	YES	1. The FORMS THICKNESS knob is not correctly adjusted. 2. The print unit is not correctly adjusted.		1400-1,3		
				NO	Proceed to item 2.				
		2	Specific columns?	YES	1. The magnet unit is not correctly mounted. 2. The point that the hammer hits is worn out. 3. The platen is worn out.		3021-1 3030 2040		
				NO	Proceed to item 3.				
		3	Specific characters?	YES	Hammer characters are worn out.		2020		
				NO	Proceed to item 4.				
		4	The event occurs sometimes.	YES	The hammer axis is worn out.		3030		
				NO	Check the paper path.		5010		
4021	The upper or lower parts of characters are missing.	1	Does the problem occur in all columns?	YES	1. The vertical position of the type band is incorrect. 2. The ink ribbon shifts vertically.		2030 6040		

MM NO.	4020, 4021

[illegible]	Symptom	Troubleshooting Item No.	Troubleshooting	Judge-ment	Possible failure	GO TO No. MAP NO.	GO TO No. REP NO.	GO TO No. TEST NO.	Note
4030	Horizontal position shifts, or the right or left parts of characters are missing.	1	Does the problem occur in all columns?	YES	1. The PSE sensor position has shifted. 2. PSE correction is incorrect.		2060		
				NO	Proceed to item 2.				
		2	Does the problem occur in all 68 odd columns or all 68 even columns.	YES	1. Magnet unit is incorrectly mounted. 2. Non-magnetic tape in the magnet unit is defective.		3020		
				NO	Proceed to item 3.				
		3	Does the problem occur in specific columns? (For mis-aligned printing, proceed to item 5.)	YES	1. Hammer flight time is abnormal. 2. Magnet is defective.		3021		
				NO	Proceed to item 4.				
		4	Does the problem only occur for specific characters?	YES	Type band is defective.		2020		
				NO					
		5	Mis-aligned printing ↓ A B C D E A B C D E A B C D E A B C D E		1. Magnet unit is defective. → Replace it. 2. Type band drive system is abnormal.		3020 2070 2080 2090		

MM NO.	4030

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
4040	Print density varies.	1	Does the problem occur in all columns?	YES	1. FORMS THICKNESS knob is not rectly correctly adjusted. 2. Power output is abnormal.		1400		
				NO	Proceed to item 2.				
		2	Forward-to-backward direction of the hammer is incorrect. (Hammer flight time must be adjusted.)	YES	Hammer section or magnet contains dirt and foreign particles, or the parts are defective. Replace the hammer unit or the magnet unit.		3021 3030		
				NO	Proceed to item 3.				
		3	Does the problem occur in several columns?	YES	1. Separator is deformed.→Replace it. 2. Front part of the hammer block is worn out.→Replace it. 3. Paper holder is worn out.→Replace it.		2130 3030 3050		
				NO					

MM NO.	4040

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
4050	Ghost print or double print		Does the problem occur repeatedly?	YES	1. Hammer, hammer plunger, or spring in hammer unit is defective. →Replace the faulty part. 2. Parts in magnet unit are defective. →Replace them. 3. Non-magnetic tape in magnet unit is damaged or has worn out.		3021		
				NO	If the problem does not occur again, it is caused by dirt in the hammer or armature.→Clean or replace the faulty unit.		3021 3030		
4060	Characters are omitted. (Without error message)	1	Hammer is locked.	YES	1. Hammer unit is defective.→Replace it. 2. Magnet unit is defective.→Replace it.		3021 3030		
				NO					
		2	Ribbon is dirty or shifts.	YES	Replace the ribbon or inspect its route.		5030 5060		
				NO					

MM NO.	4050, 4060

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judge-ment		MAP NO.	REP NO.	TEST NO.	
4070	Ribbon smudges on paper	1	Ribbon is folded or broken. (Is the folding abnormal?)	YES	Replace the ribbon and proceed to item 2.		5020		
				NO	Proceed to item 2.				
		2	Is there an obstruction in the ribbon guides (one on the right side and one on the left) or the ribbon route?	YES	Replace the ribbon guide or defective parts.		5030 5060		
				NO	Proceed to item 3.				
		3	Is there a problem in the ribbon separator?	YES	Replace the ribbon separator.		2130		
				NO					

MM NO.	4070

No.	Symptom	Troubleshooting: Item No.	Troubleshooting	Troubleshooting: Judgement	Possible failure	GO TO No.: MAP NO.	GO TO No.: REP NO.	GO TO No.: TEST NO.	Note
5010	Paper Path Problems	1	End of form is not detected.			5020			
		2	Amount of paper fed is abnormal. (Print position shifts vertically.)			5030			
		3	Paper feed pin holes are torn or deformed.			5040			
		4	Paper jam			5050			
		5	Right and left tractors cannot be adjusted.			5060			

MM NO.	5010

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judge-ment		MAP NO.	REP NO.	TEST NO.	
5020	End of form is not detected.	1	EOF switch is abnormal.	YES	1) Replace the switch.		6110		
					2) Adjust the EOF feeler.		6110		
				NO	Replace the control circuit PC board.		6050		
5030	Paper feed is abnormal.	1	Printed characters shift vertically for several columns. (Feed time is abnormal.)	YES	1) Forms compressor is worn out. Replace it.		3050		
					2) Paper feeding timing belt is loose.		4020		
					3) Motor control is defective.		6050		
				NO	Proceed to item 2.				
		2	Printed characters shift for all columns. (Amount of paper fed is abnormal.)	YES	1) Paper feed timing belt is loose.		4020		
					2) Paper feed motor is defective.		4030		
					3) Motor control is defective.		6050		
				NO	Proceed to item 3.				
		3	Only copy paper is abnormal.	YES	1) Paper specification is incorrect.				
					2) Paper width is incorrectly adjusted.				
				NO					

MM NO.	5020, 5030

MAP No.	Symptom	Troubleshooting Item No.	Troubleshooting	Judgement	Possible failure	GO TO No. MAP NO.	GO TO No. REP NO.	GO TO No. TEST NO.	Note
5040	Paper feed pin holes are torn or deformed.	1	Incorrect paper width adjustment.	YES	Check paper width adjustment.		1400		
				NO	Proceed to item 2.				
		2	Forms compressor is defective.	YES	They are deformed or contain foreign objects.		3050		
				NO	Proceed to item 3.				
		3	Right and left tractor pins cannot be aligned.	YES	Adjust pin alignment.		4050		
				NO	Proceed to item 4.				
		4	Pin is worn-out.	YES	Replace pin wheel.		4060		
				NO	Proceed to item 5.				
		5	Other defects in tractor.	YES	1) Tractor cover is defective.→Replace it. 2) Tractor shaft and bushing are worn out.→Replace them.		4040 4040		
				NO	1) Defective EOF feeler 2) Defective control				

MM NO.	5040

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judge-ment		MAP NO.	REP NO.	TEST NO.	
5050	Paper Jam	1	The jam occurs at the print position.	YES	1) Abnormal EOF feeler 2) Abnormal forms compressor 3) Foreign object 4) Paper is not correctly set in the hopper.		6110 3050		
				NO	Proceed to item 2.				
		2	The jam occurs near the print position.	YES	1) Ribbon separator is deformed. →Replace it. 2) Separator area contains dirt and foreign particles. 3) Abnormal band cover.		2130		
				NO	Proceed to item 3.				
		3	The jam occurs around the tractors.	YES	1) Tractor pin is worn out. →Replace it. 2) Forms guide is broken. 3) Tractor cover is broken. 4) Discharger is broken. →Replace it.		4060 4040 4040 4100		
				NO	Proceed to item 4.				
		4	The jam occurs in the forms rack.	YES	1) Optional stacker is broken.				
				NO					

MM NO.	5050

MAP No.	Symptom	Troubleshooting . Item No.		Judge-ment	Possible failure	GO TO No. MAP NO.	REP NO.	TEST NO.	Note
5060	Horizontal adjustment of the tractor is impossible.	1	Fine adjustment is incorrect.	YES	1. Fine adjust knob circumference is abnormal. 2. Tractor adjust lever is incorrect.		4040		
				NO					
		2	Horizontal rough adjustment of the tractor binds or is loose.	YES	1) Rubber on tractor adjust lever section is defective. 2) Spring in tractor adjust lever section is broken. 3) Other parts in the tractor are defective.				
				NO					

MM NO. 5060

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judge-ment		MAP NO.	REP NO.	TEST NO.	
6010	Ribbon Problems	1	Abnormal stacking.			6020			
		2	Ribbon is loose or separated from guide arm.			6030			
		3	Print section has moved up, causing characters to be skipped.			6040			
		5	Ribbon is broken.			6060			
		6	Ribbon is worn out.			6070			

MM NO.	6010

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judgement		MAP NO.	REP NO.	TEST NO.	
6020	Ribbon folded abnormally.	1	Ribbon is worn out.	YES	Replace the ribbon.		5020		
				NO	1) Ribbon feeding roller is dirty. 2) The roller is abnormal. 3) Ribbon fold guide is broken. 4) Ribbon arm is broken. 5) Brake section of ribbon cassette is defective.		 5040 5040 5060		
6030	Ribbon is separated from guide arm.	1	Ribbon guide is broken.	YES	Replace ribbon arm or ribbon guide.		5060		
				NO	1) Band cover is broken. 2) Ribbon separator is broken. 3) Paper size exceeds the specification.		 2130		
6040	Ribbon has moved up in the print section, causing characters to be skipped.	1	Does the problem occur while paper is feeding?	YES	1) Paper is too thick. 2) Paper thickness is incorrectly adjusted.		 1400		Appendix A
				NO	Incorrect ribbon route.	6030			
6050	Ribbon is broken.	1	Is the band a new one?	YES	The ribbon's service life is reduced when a new band is installed because the new hammer characters strike it harder. Ribbon performance improves after 500,000 to 1,000,000 lines have been printed.				
				NO	1) Ribbon is worn out. 2) Ribbon does not meet specifications. 3) Ribbon route is incorrect.				

MM NO.	6020 - 6050

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judge-ment		MAP NO.	REP NO.	TEST NO.	
6060	Ribbon's service life is reduced.	1	The ribbon does not meet specifications (or a reloaded ribbon was used).	YES	Check the difference between the specified ribbon and the non-specified one.				
				NO	Proceed to item 2.				
		2	A new print band is being used.	YES	Ribbon performance improves after 500,000 to 1,000,000 lines have been printed.				
				NO	Proceed to item 3.				
		3	A job requiring a high print ratio was being executed.	YES	Compare the print ratio for regularly executed jobs with the one for the current job.				
				NO	Proceed to item 4.				
		4	Character band or hammer face is worn out.	YES	Replace it.				
				NO					
		5	Ribbon guarantee period has expired.						

MM NO.	6060

MAP No.	Symptom	Troubleshooting			Possible failure	GO TO No.			Note
		Item No.		Judge-ment		MAP NO.	REP NO.	TEST NO.	
9010	Strange noise from cooling fan	1	Strange noise from magnet cooling fan.		Fan is broken.		6080		
		2	Strange noise from power supply cooling fan.		Fan is broken.		6020		
9020	Broken top cover	1	Top cover does not close tightly.		Broken counter balancer (right and left).		6090		
		2	Strange noise heard when the top cover is closed or opened.		Broken counter balancer or hinge.		6090		
		3	Cover interlock is broken.		1) Defective switch assembly 2) Defective control PC board		6120		

MM NO.	9010, 9020

CHAPTER 6

REPAIR, REPLACEMENT, AND ADJUSTMENT (REP)

This chapter explains the repair, replacement, and adjustment of subassemblies in the printer.

REP NO.	Item	Repair
1100	Before beginning and after finishing the job	1. If the START/STOP lamp on the operator panel is on, press the START/STOP switch to set the printer offline. (The START/STOP lamp goes off.) 2. Turn the power switch (MAIN LINE SWITCH) off. 3. After the job, reverse the above procedure to restore the original state.
1110	General precautions and jobs	1. Input power When input power is connected, make sure that the power voltage is set correctly and the band drive motor pulley matches the input frequency. 2. Turn power off when an operation such as printing is stopped in offline mode (the START/STOP lamp is off). 3. If the power is turned off by a power failure like a blown fuse, remove the cause of the failure and turn the power on again. 4. Do not take the covers off when the print band, gears, or belt is rotating. 5. Do not let ribbon lint or paper dust get into the gear or belt. 6. Be sure the power is off when mounting or removing the PC board or connector, or when replacing parts. 7. Do not fix or adjust the unit unnecessarily if it is operating normally. For example, even if an adjustable value is not standard, readjustment is not necessary if operations are normal. Do not loosen the mounting screws unnecessarily. 8. Be sure that the forms and ribbon paths are normal. 9. Insure that ordered maintenance parts numbers are correct by using the maintenance parts list or parts catalog. 10. Frame ground The following label indicates frame ground: ⏚

REP NO.	Item
1120	Tools and expendable maintenance supplies

1. Tools and expendable maintenance supplies

Parts name	Parts number	Remarks
Tools	C. List 9941A	
Print quality adjustment jig	B960-0470-T004A	
Snap ring pliers	C. wz 9227A	
Bar tension gauge	C. wz 9042A3	For 3 kg
Wire gauge	C. wz 9531A	For 0.8, 1.0, and 1.2 mm
Hollerith card	B87L-1000-0015L#07	2 pieces substitutes for 0.18 mm thickness gauge
Grease	F4-GRS-A#F6-LS3	
Lubricant	B99L-0020-0004A	
Gauze	C. wz 9134A	

2. Measuring instruments
   (1) Digital multimeter
   (2) Oscilloscope

REP NO.	Item	Cleaning
1210	Cleaning the base unit	Unless otherwise specified, the following procedure should be done before and after cleaning the base unit. 1. Follow the instructions given in REP 1100. 2. Open the top cover. 3. Lift the THROAT OPEN lever. 4. Pull the band cover latch to open the band cover. 5. After finishing the job, reverse the above procedure to return the unit to the original state.
1211	Cleaning the print band and surrounding area	1. Follow the instructions given in REP 1210. 2. Clean off dirt on the type side of the print band with dry cloth, like gauze, while rotating the drive pulley counterclockwise. Using a vacuum cleaner, clean around the print band and the inside and outside of the band cover. Clean off the ribbon lint and paper dust especially on the external forms side. **Remarks:** Do not clean the inside of the print band (the reverse side of the printing side) with a solvent, like alcohol. If it is dirty, wipe it with dry cloth, like gauze.

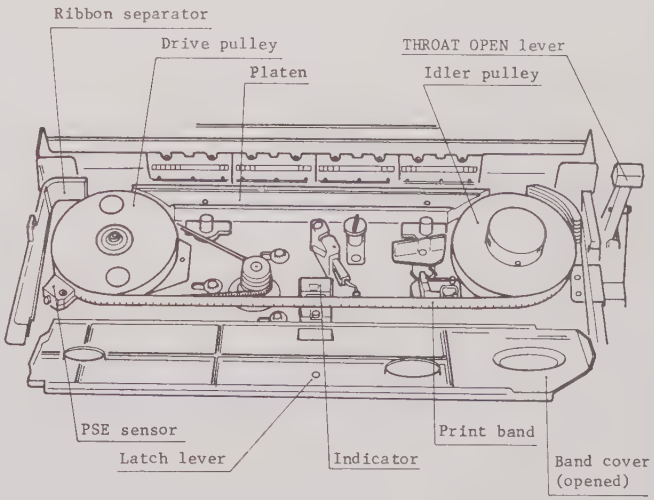


Figure 6.1 Cleaning the base unit

REP NO.	Item	Cleaning
1212	Cleaning the drive and idler pulleys	1. Follow the instructions given in REP 1210. 2. While rotating the drive pulley counterclockwise, clean the outside of the drive and idler pulleys with dry cloth, like gauze.
1213	Cleaning the indicator	1. Follow the instructions given in REP 1210. 2. Clean the top and the outside of the indicator with dry cloth, like gauze.
1214	Cleaning the PSE sensor	1. Follow the instructions given in REP 1210. 2. Using a vacuum cleaner, clean the PSE sensor head facing the print band.
1215	Cleaning the platen	1. Follow the instructions given in REP 1210. 2. Do not wipe the surface of the platen (print band side) with a solvent, like alcohol. If it is dirty, wipe it off with dry cloth, like gauze.
1216	Cleaning the ribbon separator	1. Follow the instructions given in REP 1210. 2. Remove the ribbon separator as described in REP 2130 and clean off ribbon lint or paper dust from the ribbon. Wipe stuck-on ink with a cloth dipped in ligroin or alcohol.

REP NO.	Item	Cleaning
1220	Cleaning the forms feed unit	Unless otherwise specified, the following procedure is done before and after cleaning the forms feed unit. 1. Follow the instructions given in REP 1100. 2. Open the top cover. 3. Lift the THROAT OPEN lever. 4. After finishing the job, reverse the above procedure to restore the unit to the original state.
1221	Cleaning the forms tractors	1. Follow the instructions given in REP 1220. 2. Open the tractor covers and remove paper dust from forms tractors with a vacuum cleaner. Clean the outside of the forms feed sensor roller at the left forms tractor with a soft cloth, like gauze.
1222	Cleaning the tractor shaft and the frame	1. Follow the instructions given in REP 1220. 2. Wipe off dirt on the tractor shaft with a soft cloth, like gauze. 3. Using a vacuum cleaner, remove the paper dust from the frame and the guide plate in the forms feed unit.

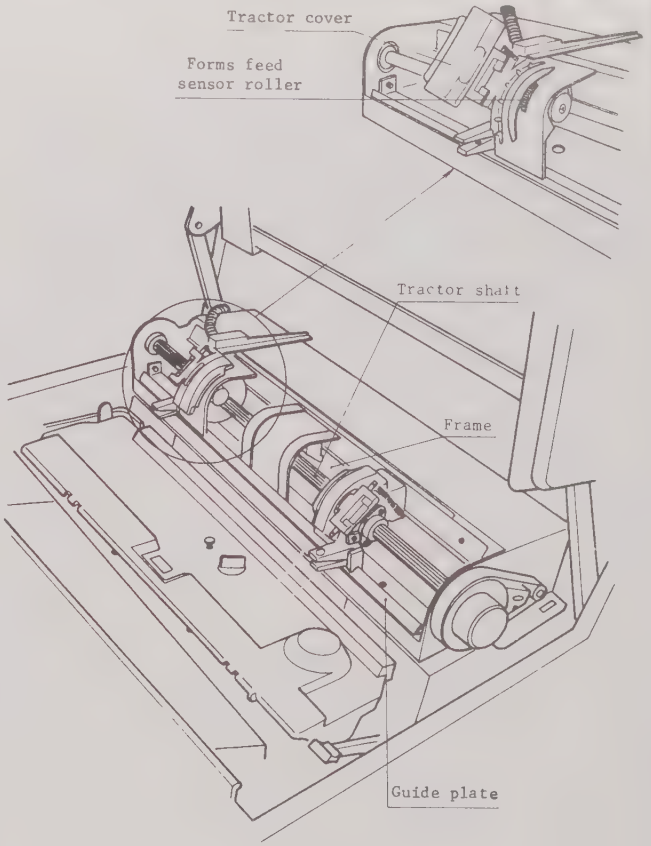


Figure 6.2 Cleaning the forms feed unit

REP NO.	Item	Cleaning
1230	Cleaning the ribbon unit	Unless otherwise specified, the following procedure is done before and after cleaning the ribbon unit. 1. Follow the instructions given in REP 1100. 2. Open the top cover. 3. Lift the THROAT OPEN lever. 4. Remove the forms side of the ribbon and put it on the band cover. 5. After finishing the job, reverse the above procedure to restore the unit to the original state.
1231	Cleaning the ribbon unit and surrounding area	1. Follow the instructions given in REP 1230. 2. When replacing the ribbon, remove ribbon lint from the ribbon container with a vacuum cleaner.
1232	Cleaning the ribbon feed rollers and surrounding area	1. Follow the instructions given in REP 1230. 2. Disengage the ribbon feed rollers by rotating the ribbon drive release lever and remove ribbon lint from the rollers with a vacuum cleaner. Do not clean with a solvent, like alcohol.
1233	Cleaning the ribbon guide and the ribbon arm	1. Follow the instructions given in REP 1230. 2. Remove the ribbon from the ribbon guide and the ribbon arm. 3. Clean off ribbon lint or ink on the guide surface with a soft cloth or sponge.

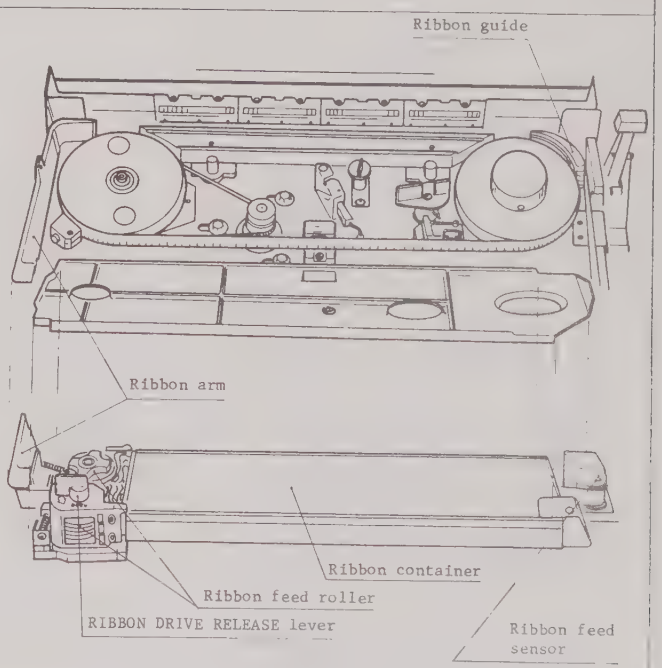


Figure 6.3 Cleaning the ribbon unit

REP NO.	Item	Cleaning
1234	Cleaning the ribbon feed sensor	1. Follow the instructions given in REP 1230. 2. Remove the ribbon from the ribbon feed sensor roller. 3. Remove ribbon lint from around the roller with a vacuum cleaner. 4. Wipe ribbon lint or ink from the roller with soft cloth, like gauze. 5. Make sure that the roller rotates smoothly and has vertical play.

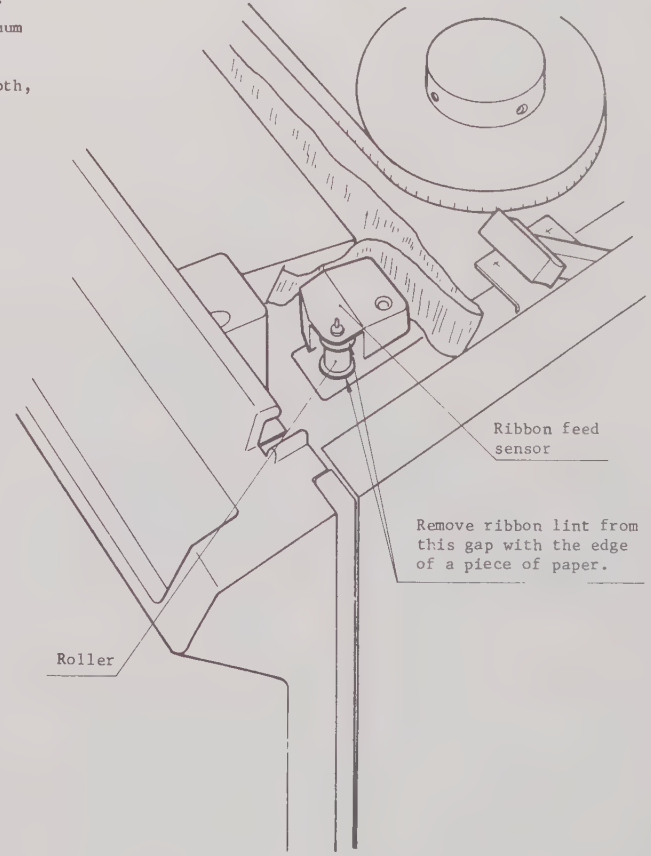


Figure 6.4 Cleaning the ribbon feed sensor

REP NO.	Item	Cleaning
1240	Cleaning the cabinet	Unless otherwise specified, the following procedure is done before and after cleaning the cabinet. 1. Follow the instructions given in REP 1100. 2. Open the top cover. 3. Lift the THROAT OPEN lever. 4. Open the front door. 5. Open the rear door. 6. After finishing the job, reverse the above procedure to restore the cabinet to the original state.
1241	Cleaning the hopper	1. Follow the instructions given in REP 1240. 2. Remove dust from the hopper with a vacuum cleaner.
1242	Cleaning the area around the fan unit and the control section	1. Follow the instructions given in REP 1240. 2. Remove screw A in the forms rack and open the forms rack. 3. Remove the fan unit as described in REP 6080 and clean dust with a vacuum cleaner. Clean the fan alarm detector carefully. Install the fan unit after cleaning. 4. Using a vacuum cleaner, clean dust from the cabinet. Be careful not to damage parts or let the vacuum pick up any loose parts.
1243	Cleaning the forms rack	1. Follow the instructions given in REP 1240. 2. Remove dust from the forms rack with a vacuum cleaner.

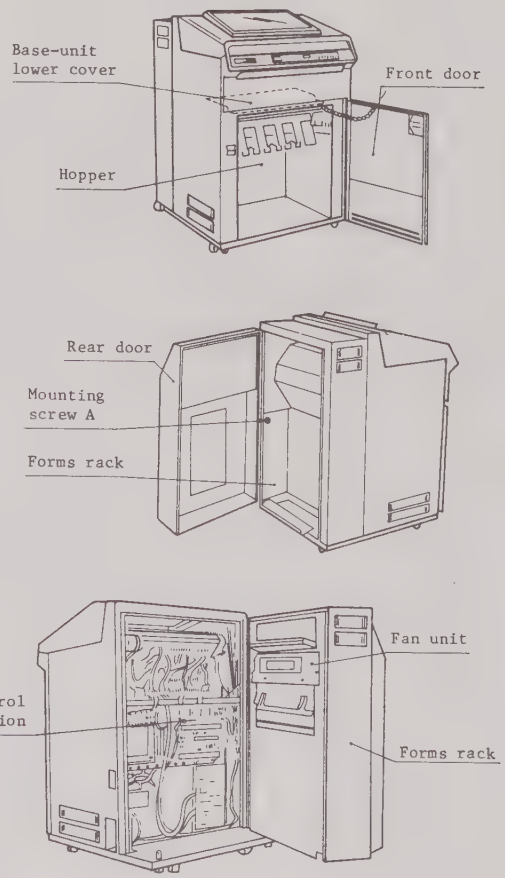


Figure 6.5 Cleaning inside the cabinet

REP NO.	Item	Lubrication
1300	Parts never lubricated	Do not lubricate the following parts: 1. The V belt (A) 2. The surface of the platen (B) 3. The surfaces of the drive pulley and idler pulley (C) 4. The surface of the tractor tire (D) 5. The surface of the forms feed sensor roller (E) 6. The timing belt (F) 7. The surface of the ribbon feed rollers (G) 8. The surface of the ribbon feed sensor roller (H) 9. Microswitches

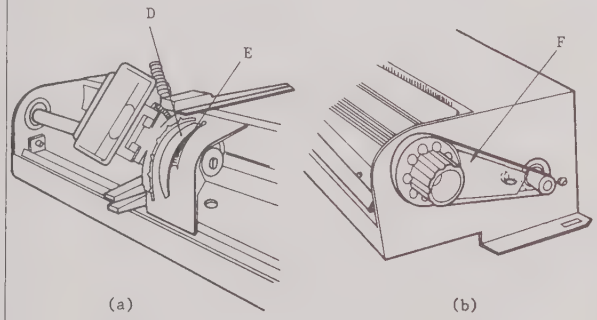


Figure 6.7 Parts never lubricated (the forms feed unit)

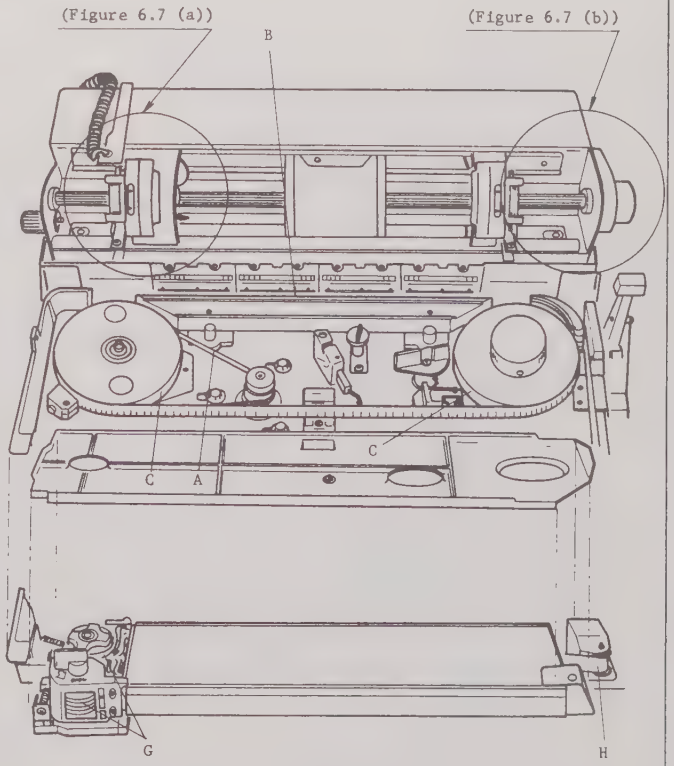
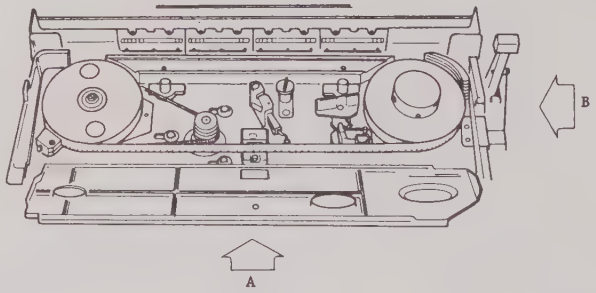
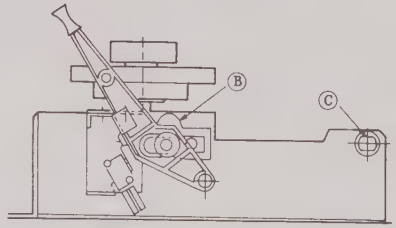


Figure 6.6 Parts never lubricated (the base unit and the ribbon unit)

REP NO.	Item	Lubrication
1310	Lubricating the base unit	1. Follow the instructions given in REP 1210 2. Remove the print unit according to instructions given in REP 3010. 3. Lubricate the base frame bearings (A) and the cams (B) (both left and right). 4. Apply grease to the rollers (C) for moving the print unit. (left and right, both parts)



Front view of the base unit (seen in the A direction)



Side view of the base unit (seen in the B direction)

Figure 6.8 Lubricating the base unit

REP NO.	Item	Repair
1400-1	Checking and adjusting the printing quality	Check 1. Set the printer offline. (See REP 1100.) 2. Set single-part standard forms and rotate the FORMS THICKNESS knob to 1 (position for single-part forms) 3. Check that the print band is at normal height. If it is not at normal height, adjust its height. (See REP 2030.) 4. Set the MODE SELECTION switch to TEST and print the shift pattern. (See the explanation for SFTPRT in TEST mode in Section 3.3.3.) 5. Examine characters like 0, 8, %, or D which easily show top or bottom clipping.

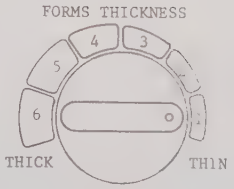


Figure 6.9 Adjusting the FORMS THICKNESS knob

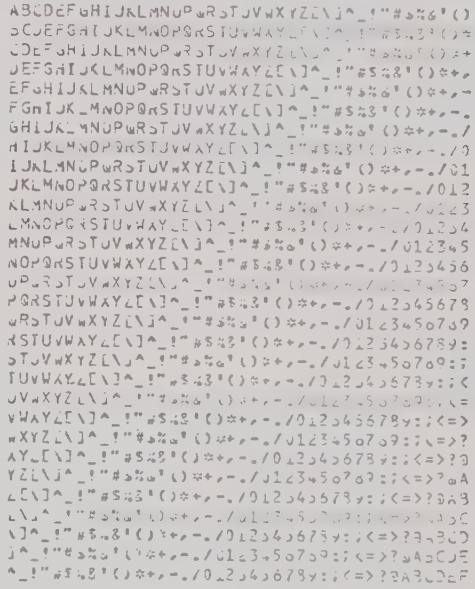


Figure 6.10 Shift print

REP NO.	Item	Repair
1400-2	Checking and adjusting the printing quality	Adjustment • If the left or right of the printed characters in all print positions is clipped. 1. Check the position of the FORMS THICKNESS knob. 2. If the clipped characters cannot be restored by using the FORMS THICKNESS knob, adjust them from the operator panel as follows: (1) Set the MODE SELECTION switch to TEST and press the FINE FORMS ADJUST switch repeatedly until PSEADJ is displayed in the STATUS indicator. (See 3.3.3) (2) Start printing by pressing the START/STOP switch. (3) Press the FINE FORMS ADJUST switch ⬆ or ⬇ until printed characters are not clipped. If the right side is clipped, operate the switch ⬆ to increase the number in the STATUS indicator. If the left side is clipped, operate the switch ⬇ to decrease the number. When the printing is satisfactory, press the START/STOP switch to set the printer offline. • If the left or right of a printed character at a certain print position is clipped. Using an Allen wrench, adjust the printing position by rotating the backstop screw of the hammer magnet at the print position. (See Figure 6.11)

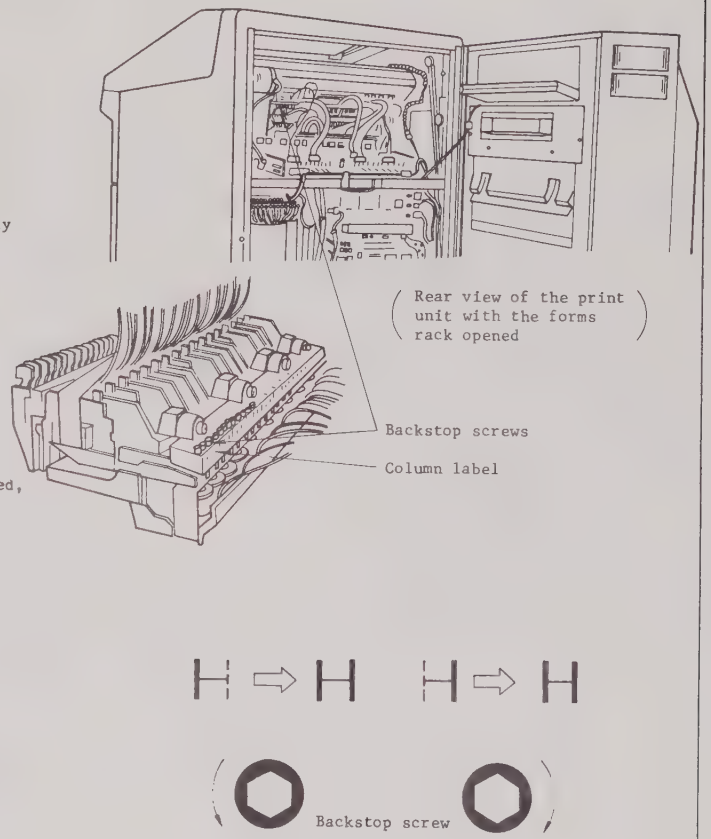


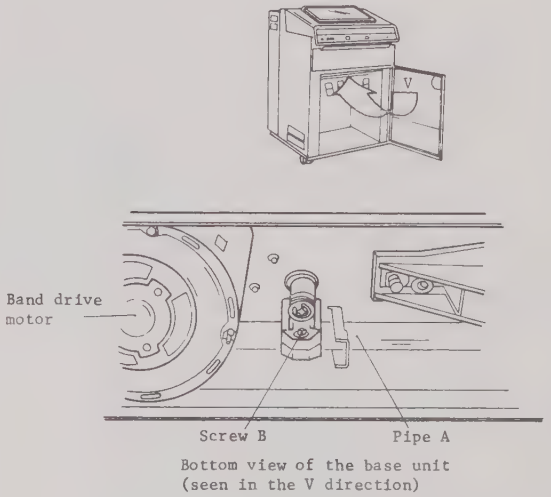
Figure 6.11 Direction for adjusting the backstop screw

REP NO.	Item	Repair
1400-3	Checking and adjusting the printing quality	• If all the printing is fading at the top of odd-numbered column characters and at the bottom of even-numbered column characters: (See Figure 6.12 (a)) 1. Rotate the FORMS THICKNESS knob toward THIN until correct print is obtained. 2. Calibrate the knob as follows: (1) Open the front door. (2) Remove the base-unit lower cover by loosening its mounting screws and shifting it backward. (3) Holding pipe A firmly so that it does not move, loosen screw B. (4) Holding pipe A firmly, tighten screw B after setting the FORMS THICKNESS knob to 1. (5) Attach the base-unit lower cover. (6) Close the front door. • If all the printing is fading at the top of even-numbered column characters and at the bottom of odd-numbered column characters: (See Figure 6.12 (b)) 1. Rotate the FORMS THICKNESS knob toward THICK until the correct print is obtained. 2. Carry out the procedure shown in item 2 above.

(a) An example of light top at odd-numbered columns and light bottom at even-numbered columns

(b) An example of light top at even-numbered columns and light bottom at odd-numbered columns

Figure 6.12 Enlarged figure showing the top and bottom of characters fading



Bottom view of the base unit (seen in the V direction)

Figure 6.13 Calibrating the FORMS THICKNESS knob

REP NO.	Item	Repair
2000	Checking, replacing and adjusting the base unit	Unless otherwise specified, the following procedure should be done before and after checking, replacing and adjusting the base unit. 1. Follow the instructions given in REP 1100. 2. Open the top cover. 3. Lift the THROAT OPEN lever. 4. Open the band cover by pulling the cover latch. 5. After finishing the job, reverse the above procedure to return the unit to the original state.

REP NO.	Item	Repair
2020	Checking the print band service life	Check 1. Print the shift pattern at all print positions. 2. Make a visual check of characters frequently used (numbers like 0 or 1) and small characters (comma or period) in the print of the second or subsequent copies of single-part or five-part forms. 3. If the following print appears, replace the print band.

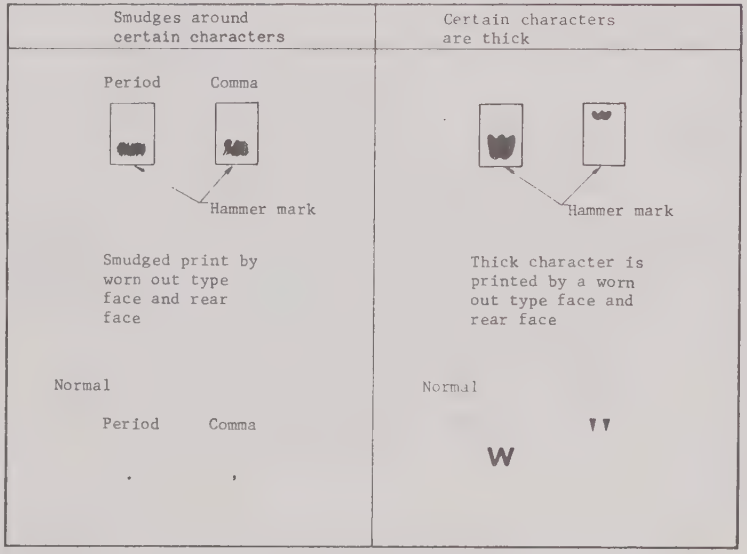


Figure 6.14 Printing with the worn print band

REP NO.	Item	Repair
2030-1	Replacing the print band	Removal 1. Follow the instructions given in REP 2000. 2. Remove the ribbon separator. (see REP 2130.) 3. Rotate the BAND EXCHANGE knob toward BAND EXCHANGE. 4. Lift the ribbon arm upward and remove the ribbon on the forms side. Then restore the ribbon arm to the original position. 5. Carefully remove the print band upward. Be careful not to damage the type on the print band by catching it on the PSE sensor. Do not let a magnetic tool or screwdriver touch the print band. Cleaning After removing the print band, remove ribbon lint and paper dust from the print band running section with a vacuum cleaner. Installation 1. Keep the BAND EXCHANGE knob at BAND EXCHANGE. 2. Remove the ribbon separator and the ribbon on the forms side. 3. Insert the print band until the upper end of the print band almost reaches the upper surface of the drive and idle side pulleys. Be careful not to let the print band touch the PSE sensor. 4. Then rotate the BAND EXCHANGE knob to NORMAL.

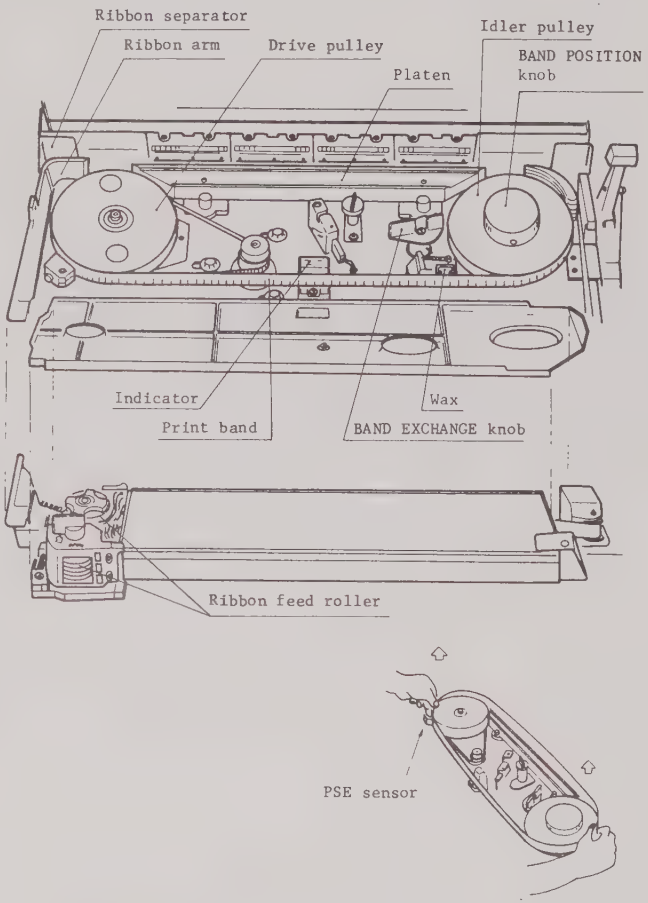


Figure 6.15 Replacing the print band

REP NO.	Item	Repair
2030-2	Replacing the print band	5. Using your fingers, rotate the drive pulley counterclockwise until the print band position is stabilized (rotate about 10 times). 6. Rotating the drive pulley, look at the top of the indicator. 7. Turn the BAND POSITION knob until the upper edge of the print band aligns with the pointer as shown in Figure 6.16. 8. Install the ribbon separator. 9. Set the ribbon on the ribbon root and rotate the ribbon feed roller to tighten the ribbon. 10. Follow the instructions given in REP 2000 to restore the base unit to the original state.

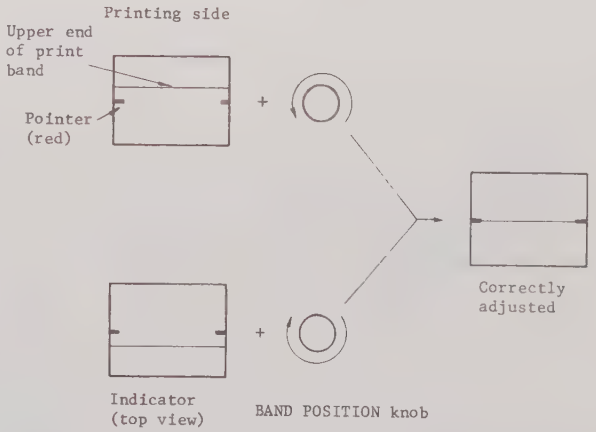


Figure 6.16 Adjusting the print band position

REP NO.	Item	Repair
2040	Replacing the platen (B020-1500-V115A)	Replacement 1. Follow the instructions given in REP 2000. 2. Remove the ribbon on the printing side and remove the print band. (See REP 2030.) 3. Remove the two mounting screws (A) and replace the platen. 4. Reverse the above procedure to reassemble. Install the platen, putting the rear of the platen precisely at the stoppers. Remarks Do not lubricate the print band slide section of the platen. Cleaning Wipe the area where the print band slides on the platen with a dry cloth to clean dirt, like oil or ribbon ink. Remarks: Do not clean the platen with solvent or alcohol.

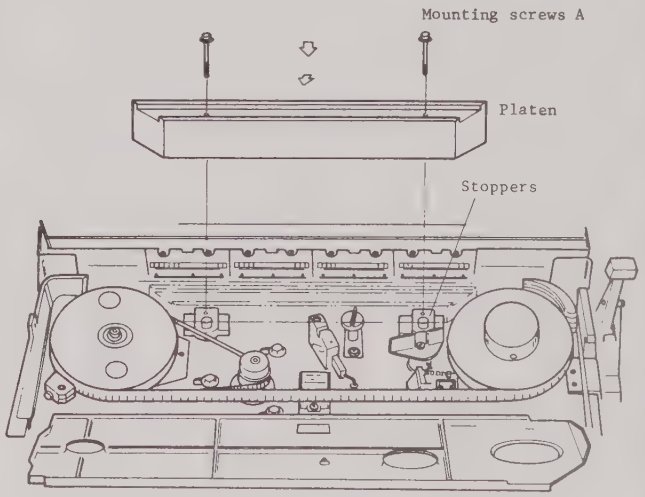


Figure 6.17 Installing the platen

REP NO.	Item	Repair
2050	Checking and adjusting the PSE sensor output waveform	Check 1. The standard value is shown in Table 6.1 below.

Table 6.1 PSE sensor output standard

	Vmin V	Vmax V	Vmax / Vmin	Period T .s (Not printing)
300 LPM	≥ 0.8	≤ 3.0	≤ 1.5	1240.6 ±26
600 LPM	≥ 0.8	≤ 3.0	≤ 1.5	1240.6 ±26
900 LPM	≥ 1.0	≤ 5.0	≤ 1.5	715.7 ±15

2. Using an oscilloscope, check the waveform across pin 1 (PSEP) and pin 13 (0V) of CN8 of the control circuit PC board (B16B-8780-0100A#U) (see Figure 6.63 in REP 6050) while rotating the print band (see the explanation for BNDST in TEST mode in Section 3.3.3).

Adjustment

1. If the standard waveform is not obtained, adjust the PSE sensor as described in REP 2060. If the standard waveform is not obtained after doing this, replace the print band or the PSE sensor as described in REPs 2030 and 2060.
2. Make sure the period is as shown in Figure 6.18. The dotted line indicates the home pulse.

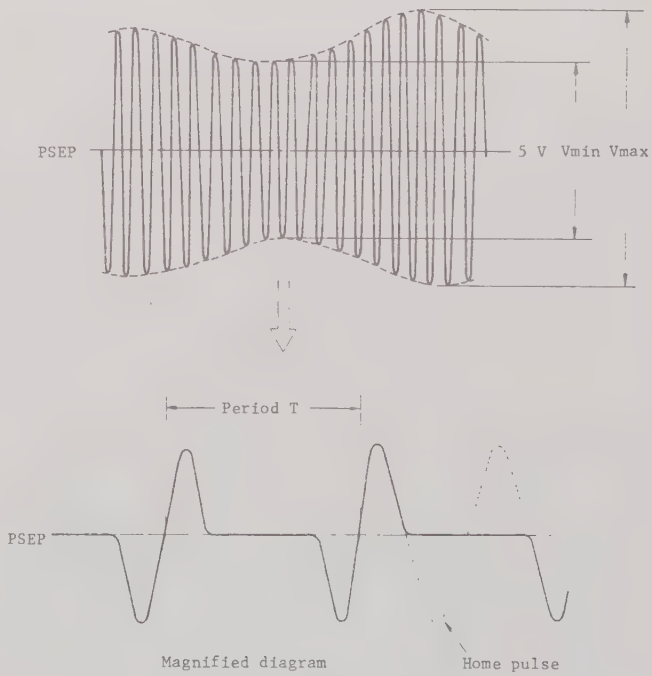


Figure 6.18 Output waveform of the PSE sensor

REP NO.	Item	Repair
2051	Confirming and adjusting the timing between the *PSWIND and PSEM signals	Check Figure 6.19 shows the timing between the *PSWIND and PSEM signals. Using an ascilloscope, make sure that time T3 satisfies the value shown in Table 6.2. Table 6.2 Timing μs | | M3040, M3041 | M3042 | |---|---|---| | T1 | 370 | 220 | | T2 | 740 | 439 | | T3 | 280 ±5% | 100 ±5% | Adjustment 1. Confirm the output voltage. (See REP 6010.) 2. Set the T3 value to that shown in Table 6.2 by adjusting VR1 on the control board using an oscilloscope. (See REP 6050.) 3. After the adjustment, print H characters with the FIXPRT test in TEST mode to confirm print quality.

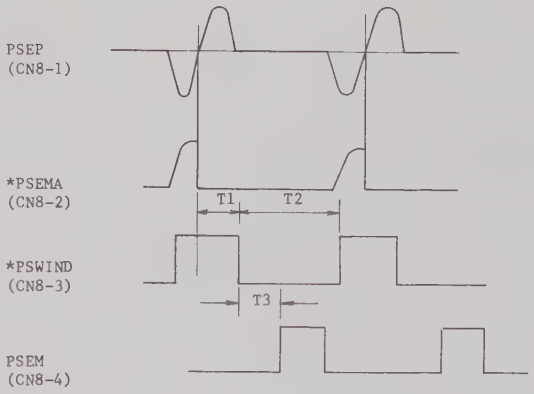


Figure 6.19 Timing between the *PSWIND and PSEM signals

REP NO.	Item	Repair
2060	Checking, replacing and adjusting the PSE sensor (B86L-1320-0115A)	Replacement 1. Follow the instructions given in REP 2000. 2. Open the front door and remove the front panel (See REP 6070). 3. Pull out connector CN33. 4. Loosen the mounting screw (B) and remove the PSE sensor. Replace the sensor. 5. Reverse the above procedure to reassemble. Adjustment 1. Loosen the mounting screw (B). Inserting two sheets of a Hollerith card (0.18 mm thickness) between the print band and the PSE sensor head with a type on the print band facing at the head, press the PSE sensor toward the print band and fasten the PSE sensor temporarily. 2. Fix the PSE sensor after adjusting the distance between the PSE sensor and the print band so that the value prescribed in REP 2050 is obtained. 3. Check the printing quality as described in REP 1400.

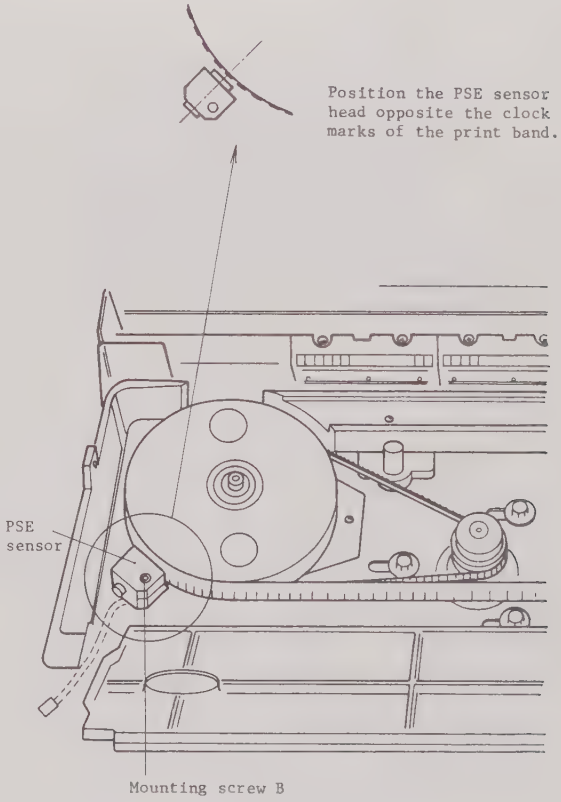
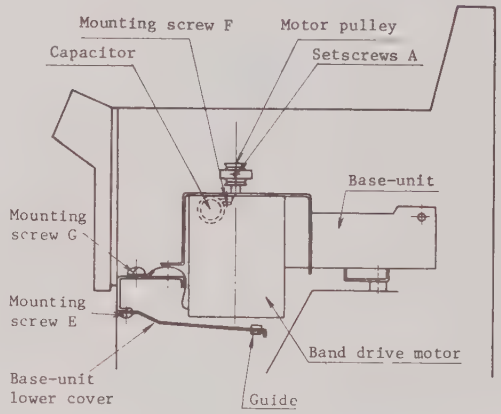


Figure 6.20 Adjusting the PSE sensor position

REP NO.	Item	Repair
2070	Replacing the band drive motor (B90L-1270-0013A/0011A)	Replacement 1. Follow the directions given in REP 2000. 2. Remove mounting screw (D) and remove the V-belt cover. 3. Open the front door, loosen the two mounting screws (E) from the bottom. Then remove the base-unit lower cover by pushing it to the rear to free it from the screws (E) and pulling it to the front. 4. Pull out connector CNP41. 5. Loosen the capacitor clamp mounting screw (F) and pull out the capacitor. Remove the FG terminal mounting screw (G) and remove the FG wire. 6. Loosen the three mounting screws (H). Shift the motor and remove the V-belt at the motor pulley. 7. Holding the motor at the bottom of the base unit, remove the mounting screws. Lowering the motor, remove it from the bottom. 8. Loosen the two setscrews (A) and remove the pulley. 9. Reverse the above procedure to reassemble. Adjustment V-belt tension is adjusted as described in REP 2110. Note: Press the pulley all the way down and fasten it with the correct stamped (indicating 50 or 60 Hz) surface pointing upward.



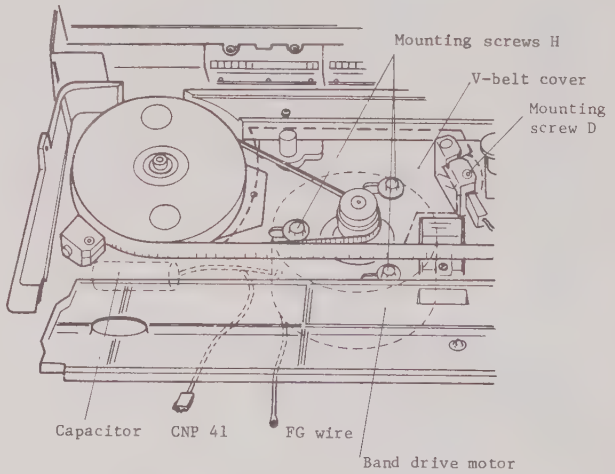


Figure 6.21 Replacing the band drive motor

REP NO.	Item	Repair
2080	Replacing the drive pulley (B020-1500-V109A)	Replacement 1. Follow the instructions given in REP 2000. 2. Remove the V-belt cover. (See REP 2070) 3. Remove the print band as described in REP 2030. 4. Loosen the three mounting screws (H). Shift the motor and replace the V-belt. 5. Remove the screw (I) on the pulley. 6. Remove the pulley by pulling it straight upward so that it does not touch the PSE sensor head. 7. Reverse the above procedure to reassemble. Adjustment The V-belt tension is adjusted as described in REP 2100. Check 1. After assembly, turn the print band drive pulley counterclockwise by hand to check that the print band runs smoothly. 2. Check and adjust the height of the print band using the indicator. (See REP 2030.)

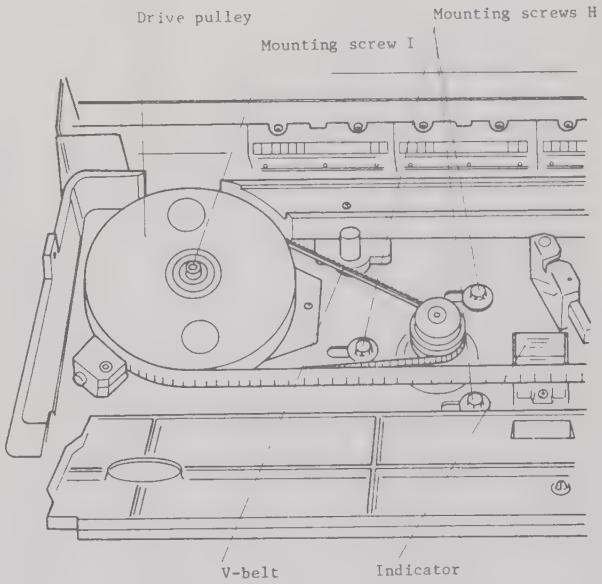


Figure 6.22 Replacing the drive pulley

REP NO.	Item	Repair
2090	Replacing the idler pulley (B020-1500-V108A)	Replacement 1. Follow the instructions in REP 2000. 2. Remove the print band as described in REP 2030. 3. Loosen the two setscrews (B) and pull out the BAND POSITION knob. 4. Remove the idler pulley and replace it. 5. Reverse the above procedure to reassemble. Install the idler pulley without play by pressing the BAND POSITION knob downward. Check 1. After reassembly, rotate the drive pulley counterclockwise by hand to check that the print band runs smoothly. 2. Check and adjust the height of the print band using the indicator. (See REP 2030.)

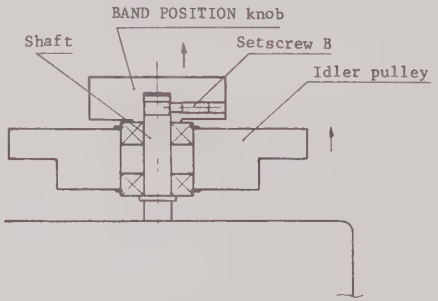


Figure 6.23 Replacing the idler pulley

REP NO.	Item	Repair
2100-1	Replacing and adjusting the V-belt (CT-5M-545-MITSUBOSHI)	Replacement 1. Remove the drive pulley as described in REP 2080 to remove the V-belt from the drive and motor pulleys. 2. Reverse the above procedure to reassemble. Adjustment 1. Loosen the mounting screws (H). 2. Insert a standard screwdriver into the oblong hole (for M3040 and M3041) or into the adjustment hole (for M3042) and then tighten the V-belt by pressing on the side of the motor. 3. Tighten the screws (H) temporarily. 4. Measure the belt tension. (See the section on tension check.) 5. If the tension is within standards, tighten the screws (H). 6. Check that the tension is correct by measuring it again. 7. Check the PSE sensor output and the timing. (See REPs 2050 and 2060.)

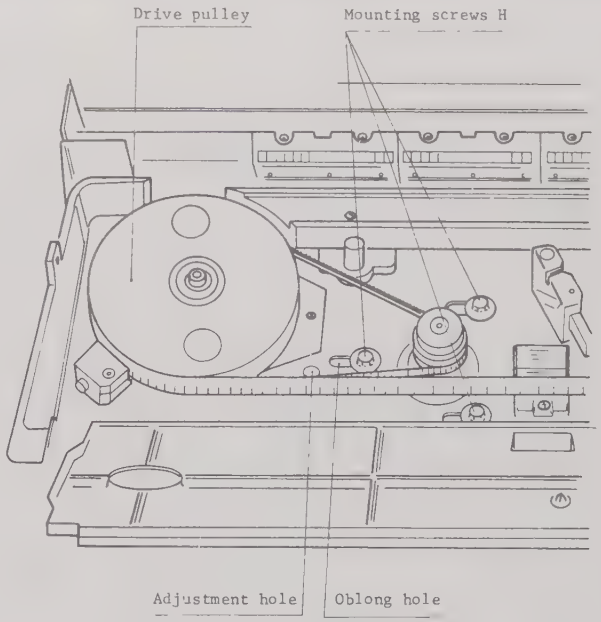
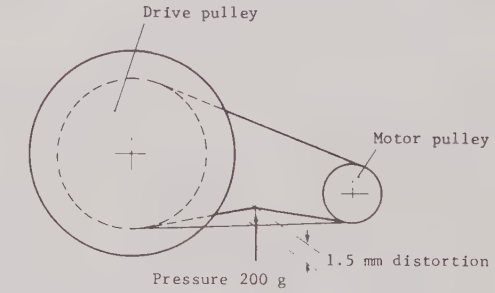


Figure 6.24 Replacing the V-belt

REP NO.	Item	Repair
2100-2	Replacing and adjusting the V-belt (CT-5M-545-MITSUBOSHI)	Tension check 1. Place a bar tension gauge on the V-belt between the two pulleys and check that the slack is 1.5 mm under 200 g of pressure. (Remarks) 1. Pressure must be applied at or near the mid-point between the motor pulley shaft and the drive pulley shaft. 2. Pressure must be applied at the mid-point of the belt width.



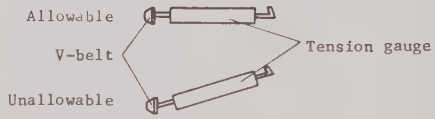


Figure 6.25 Adjusting the V-belt tension

REP NO.	Item	Repair
2110	Replacing the indicator (B020-1500-V116A)	Replacement 1. Follow the instructions given in REP 2000. 2. Remove the print band as described in REP 2030. 3. Mark the base frame and the block as shown in Figure 6.26. 4. Remove the mounting screw (J) and remove the indicator and block and replace the indicator. Remarks: Do not erase the mark indicating the block position on the base frame and the indicator position on the block. 5. Reverse the above procedure to reassemble. 6. Assemble the indicator and the block, placing the block and indicator at the position indicated by the mark.

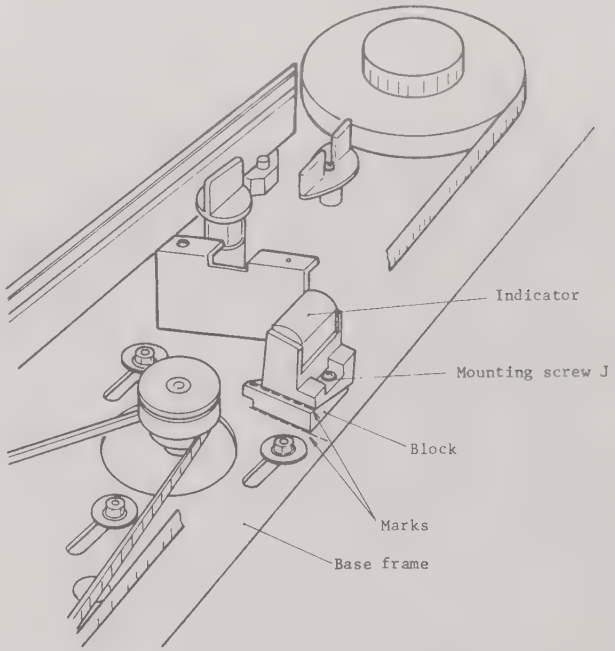


Figure 6.26 Replacing the indicator

REP NO.	Item	Repair
2120	Replacing the wax (B020-1500-V155A)	Replacement 1. Follow the instructions given in REP 2000. 2. Set the BAND POSITION knob to BAND EXCHANGE. 3. Remove the two mounting screws (K) to remove the wax assembly. 4. Remove the wax unit from the waxer assembly and replace it with a new one. 5. Install in the reverse of the removal procedure. 6. After setting the BAND EXCHANGE knob to NORMAL, make sure that the front of the wax face is made to touch the rear of the print band face by the tension spring force. (Check the cam lever movement.)

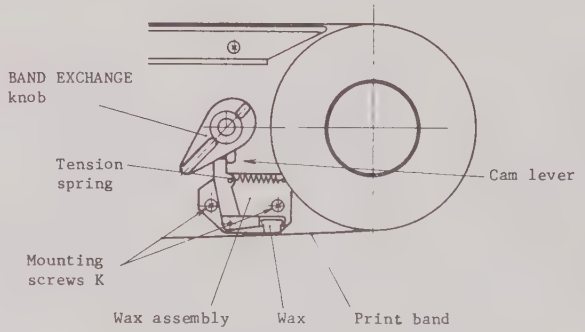


Figure 6.27 Replacing the wax

REP NO.	Item	Repair
2130	Replacing the ribbon separator (B020-1500-V125A)	1. Follow the instructions given in REP 2000. 2. Remove the ribbon separator by lifting the projections on its left and right. 3. Insert the new ribbon separator until it is seated. Do not reverse the left and right sides of the ribbon separator. There is a cutout on the left side. 4. Make sure when lowering the THROAT OPEN lever that the pins are in the holes at the left and right of the ribbon separator. Check that the ribbon separator does not come out.

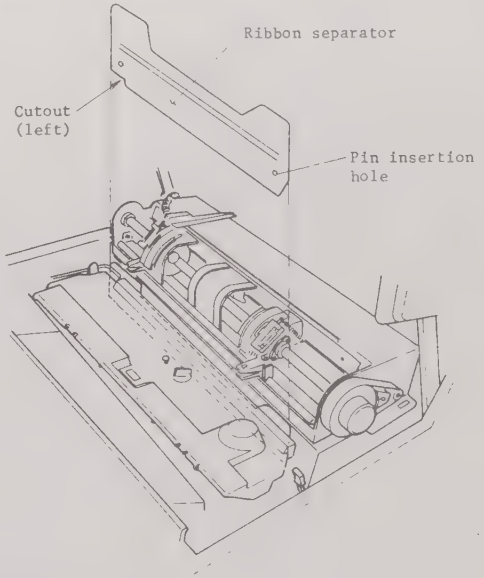
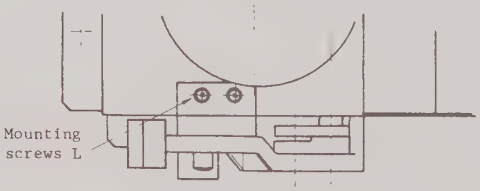
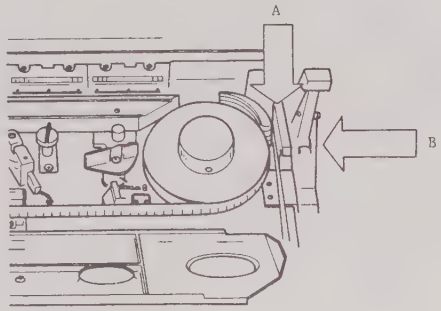


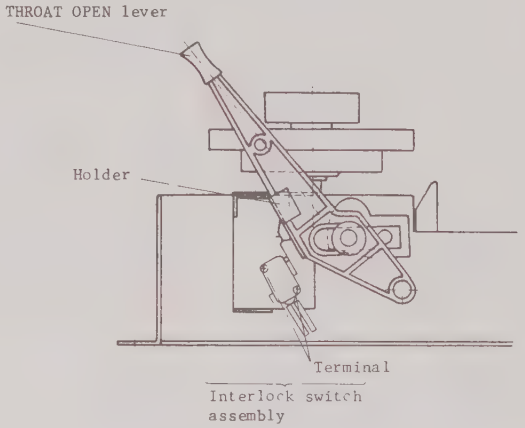
Figure 6.28 Installing the ribbon separator

REP NO.	Item	Repair
2140	Replacing the THROAT OPEN lever interlock switch assembly (B020-1500-V113A)	Replacement 1. Follow the instructions given in REP 2000. 2. Remove the two mounting screws (L) and lift the THROAT OPEN lever interlock switch assembly upward. 3. Remove the terminals connected to the switch to replace the THROAT OPEN lever interlock switch assembly. 4. Reverse the above procedure to reassemble. Check that the switch contacts operate normally by opening and closing the THROAT OPEN lever. Also check that there is no play between the holder and the lever.



Top view of the THROAT OPEN lever (seen in the A direction)





Side view of the THROAT OPEN lever (seen in the B direction)

Figure 6.29 Replacing the THROAT OPEN lever interlock switch assembly

REP NO.	Item	Repair
2150	Replacing the band cover interlock switch assembly (B020-1500-V117A)	Replacement 1. Follow the instructions given in REP 2000 . 2. Remove the base-unit lower cover and the V-belt cover. (See REP 2070.) 3. Remove the two mounting screws (M) from under the base unit and lift the band cover interlock switch assembly. 4. Remove the terminals connected to the switch to replace the band cover interlock switch assembly. 5. Install it in the reverse of the removal procedure. 6. Make sure that the band cover latch correctly operates the switch.

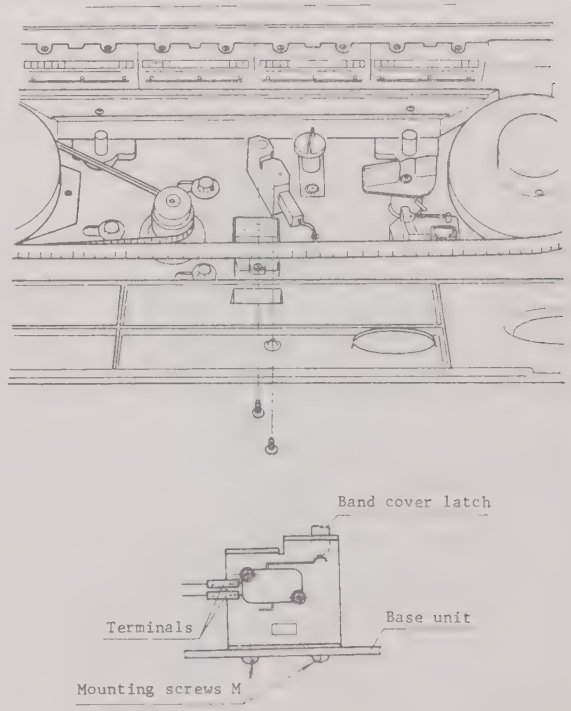


Figure 6.30 Replacing the band cover interlock switch assembly

REP NO.	Item	Repair
2160	Replacing the band cover (B020-1500-V140A)	Replacement 1. Follow the instructions given in REP 2000. 2. Remove the two mounting screws (N) and remove the band cover. 3. Attach the band cover in the reverse of the removal procedure. Tighten the two screws (N) after aligning the column scale and the actual print position by test printing. For the test printing procedure, see the explanation for SFTPRT in TEST mode in Section 3.3.3. 4. Make sure that the band cover interlock switch is correctly operated by the band cover latch.

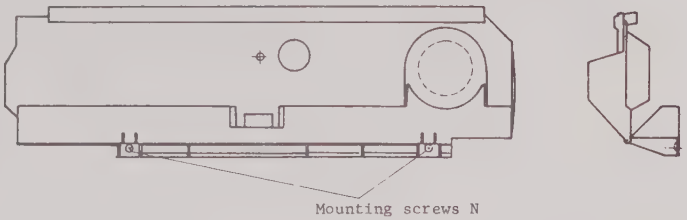


Figure 6.31 Replacing the band cover

REP NO.	Item	Repair
3010	Installing and removing the print unit	Removal 1. Follow the instructions given in REP 1100. 2. Open the forms rack (see REP 1242) and pull out the eight connectors (CNA to CNH) for the hammer magnet driver. (See Figure 6.63 in REP 6060.) 3. Remove the terminals of two FG cables. 4. Open the top cover. 5. Remove the forms feed unit as described in REP 4010. 6. Lift the THROAT OPEN lever. 7. Remove the ribbon separator. 8. Pressing the print unit backward, lift it to remove it. See Figure 6.32. (The print unit guides are separated from the base unit roller.) Installation 1. Set the base unit roller into the guide section at the rear of the print unit. 2. Install the ribbon separator. 3. Keeping the THROAT OPEN lever upward, lift the print unit by holding it as indicated in Figure 6.32 and shift it slightly forward to set the front roller into the front guide section. 4. Check that the print unit moves smoothly by lifting and moving down the THROAT OPEN lever. 5. Insert connectors CNA to CNH (from hammer magnets) according to label instructions. 6. Connect the FG cables. 7. Close the forms rack and the top cover.

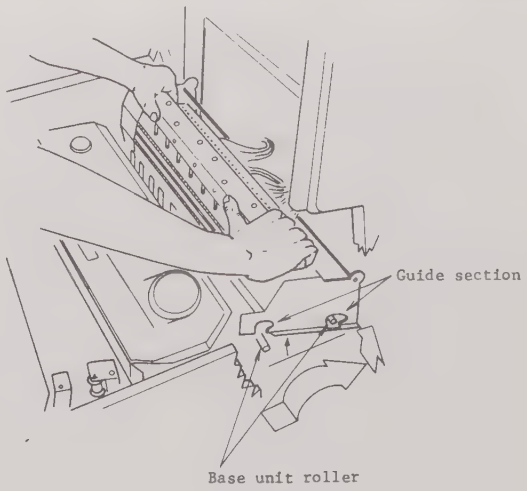
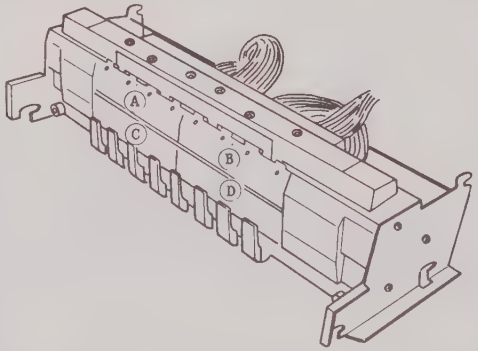


Figure 6.32 Position for removing the print unit

REP NO.	Item	Repair
3020-1	Replacing and adjusting the hammer magnet assembly (B020-1500-T501A) <Including label (B020-1500-X533A) replacement>	Removal 1. Remove the print unit as described in REP 3010. 2. Remove hammer magnet assembly A in Figure 6.33 as follows: • For hammer magnet assembly A, remove the three mounting screws (A) while supporting the assembly. Remove hammer magnet assembly A backward after shifting it slightly backward so that its hammers do not interfere with the hammers of hammer magnet assembly D, and then shift it toward the right side panel. 3. Remove hammer magnet assembly B, C and D in Figure 6.33 as follows: • For hammer magnet assembly B, C, and D, remove its three mounting screws (A) while supporting the assembly and then move it backward in the same manner as for hammer magnet assembly A. Installation 1. Reverse the above procedure to reassemble. 2. Place the lower hammer magnet assembly on the frame. Push the hammer magnet assembly to the positioning plate for the front and column-1 directions, and tighten the mounting screws. (See Figure 6.33.)



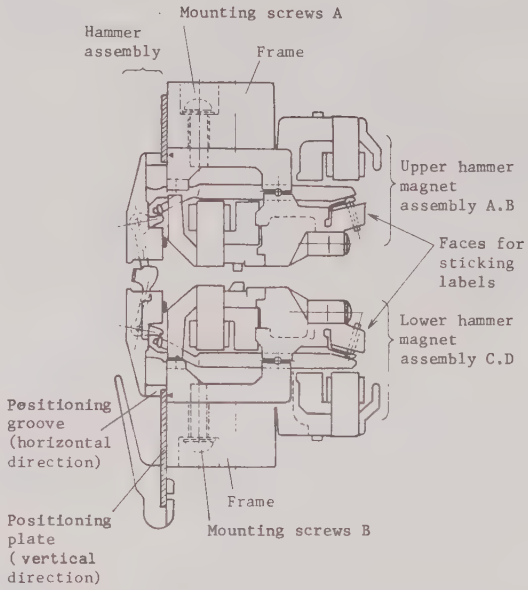


Figure 6.33 Hammer magnet assembly

REP NO.	Item	Repair
3020-2	Replacing and adjusting the hammer magnet assembly (B020-1500-T501A) <Including label (B020-1500-X533A) replacement>	3. Place the upper hammer magnet assembly on the inner surface of the upper frame. Determine the front position by placing it on the upper positioning plate. Find the horizontal position so that hammers of the upper hammer magnet assembly and hammers of the lower hammer magnet assembly are the same distance from each other. Attach the assembly by tightening the mounting screws. (See Figure 6.34.) 4. Check that the lead wires of the hammer magnet assembly are not pinched between parts. 5. Put the label indicating the hammer magnet print positions on the correct position. When replacing the hammer magnet assembly, the label indicating print positions must be applied. (See Figure 6.35) 6. Restore the assembly to the original position as described in REP 3010. 7. Check and adjust the printing quality as described in REP 1400. Note: Each hammer magnet assembly has two sections for front-to-back positioning.

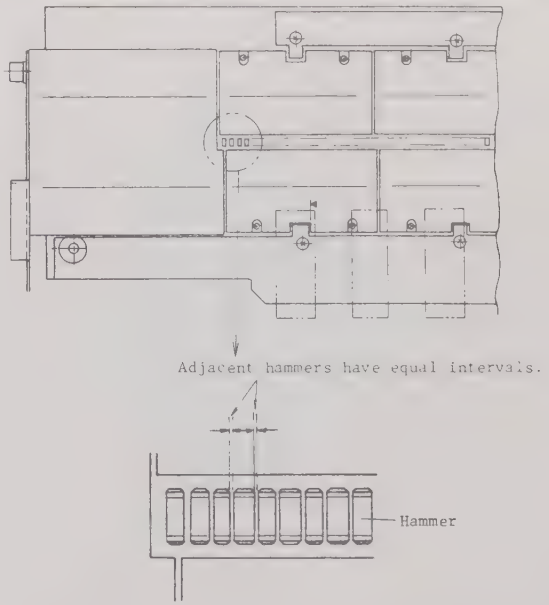


Figure 6.34 Hammer arrangement

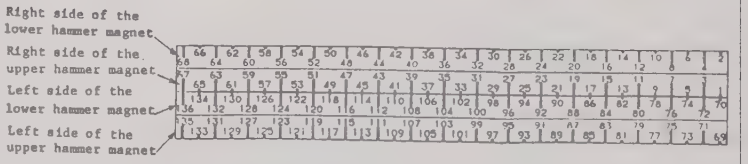

Right side of the lower hammer magnet
Right side of the upper hammer magnet
Left side of the lower hammer magnet
Left side of the upper hammer magnet
Seen from the face for sticking labels.

Figure 6.35 Labels

REP NO.	Item	Repair
3030	Replacing the hammer assembly (B020-1500-V520A)	Replacement 1. Remove the print unit as described in REP 3010. 2. Remove two mounting screws (C) holding the hammer assembly and remove the hammer assembly and replace it. 3. Align the projection for guiding the hammer frame with the guide groove of the core block frame, and fasten the hammer assembly in place while pressing down (lower assembly) or up (upper assembly) and in the X direction. 4. After fastening the hammer assembly, move it by hand to check that the hammer operates smoothly. 5. After assembling the unit, restore it to the original state as described in REP 3010. 6. Check and adjust the print quality as described in REP 1400.

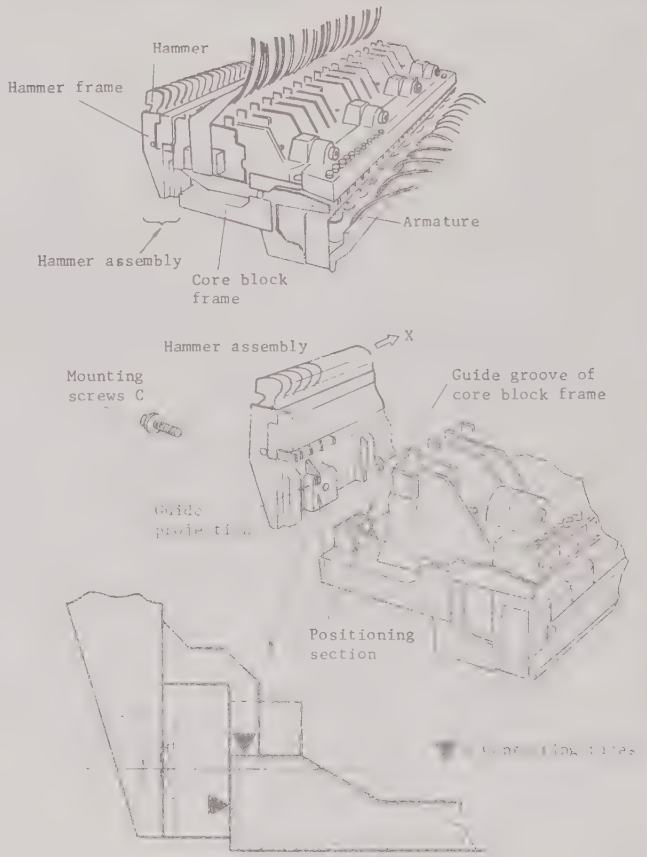


Figure 6.36 Replacing the hammer assembly

REP NO.	Item	Repair
3040-1	Replacing the residual tape (B020-1500-V508A)	Replacement I. Replacement of residual tape for the inner magnet 1. Remove the hammer magnet assembly as described in REP 3020. 2. Remove the eight mounting screws (D and E) and lift off the core block assembly. The armature and armature shaft must be left as is. 3. Remove the residual tape from the core block assembly, and replace it. 4. Set the residual tape in the groove of the core block assembly. Be sure that the rubber tape section is not located where armatures are attached. 5. Perform the removal process in the reverse of reassembly. Insert the armatures and the positioning guide projections of the hammer assembly into the core block assembly guide groove. Also clamp the armature shaft vertically. Fix the core block assembly by tightening mounting screws (D) then mounting screws (E). II. Replacement of residual tape for the outer magnet 1. Remove the hammer magnet assembly as described in REP 3020. 2. Remove the residual tape by passing it over the connector to the hammer magnet driver. 3. To replace the residual tape with the new one, reverse the removal procedure.

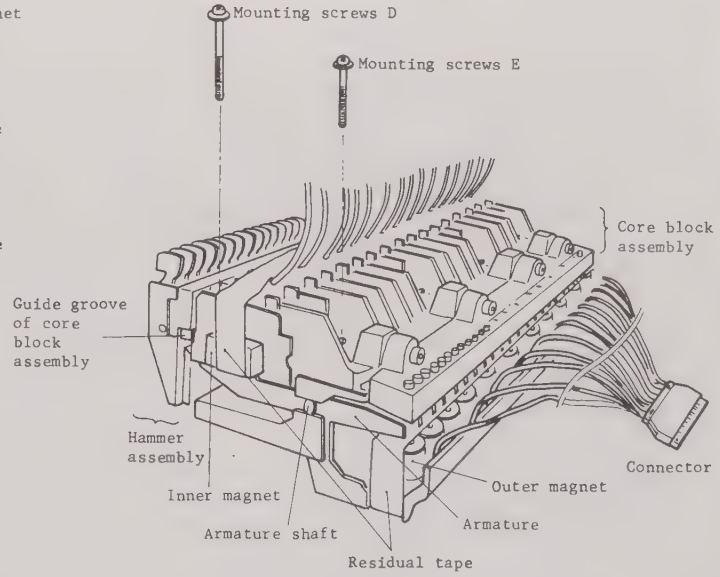


Figure 6.37 Replacing the residual tape

REP NO.	Item	Repair
3040-2	Replacing the residual tape (B020-1500-V508A)	Inspection 1. The residual tape must stick to the magnet core correctly. 2. Restore to the original state as described in REP 3010. 3. Adjust and inspect the printing quality as described in REP 1400.

REP NO.	Item	Repair
3050	Replacing the forms compressors (B020-1500-X213A)	Replacement 1. Remove the print unit as described in REP 2010. 2. Pull the forms compressors from the square slots of the positioning plate and replace them. 3. Check whether the eight forms compressors are aligned correctly. 4. Reassemble by reversing the removal procedure.

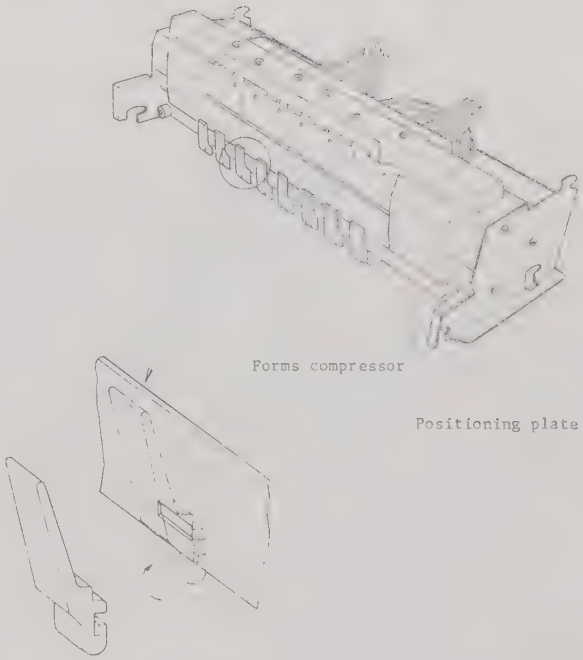


Figure 6.38 Replacing the forms compressor

REP NO.	Item	Repair
4010	Installing and removing the forms feed unit (B020-1500-V300A)	Removal 1. Follow the instructions given in REP 1100. 2. Open the top cover. 3. Open the forms rack. (See REP 1242.) 4. Remove connector CNP31 of the forms feed motor and CNP35 of the forms feed sensor. 5. Remove two mounting screws (A) and remove the unit by lifting it up. Installation 1. Mount the unit by reversing the removal procedure. 2. Mount the unit by pulling it toward you, putting section B, shown in Figure 6.39, against the print unit and tighten the two mounting screws (A). 3. Mount the forms and execute the SFTPRT in TEST mode, making sure that no error occurs.

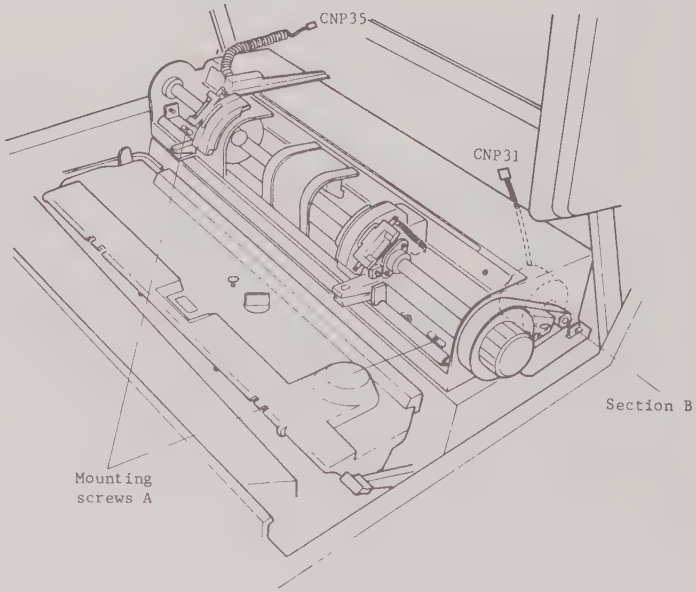


Figure 6.39 Forms feed unit

REP NO.	Item	Repair
4020	Checking, replacing and adjusting the timing belt (B30L-1820-0005A#Z160)	Replacement 1. Follow the instructions given in REP 1100. 2. Open the top cover. 3. Remove mounting screw (B) from the inside of the forms feed unit right frame to remove the safety guard. 4. Loosen two mounting screws (C) and shift the forms feed motor to loosen the tension on the timing belt and replace the belt. 5. Install the timing belt by reversing the removal procedure. Adjustment 1. Remove the safety guard. 2. Loosen the two mounting screws (C) so that there is 4 to 5 mm of slack when a 1 kg load is applied. Measure this with the tension gauge at the center of the belt, and adjust by shifting the forms feed motor position. To shift the forms feed motor, insert the bit of a flat-bit screwdriver into hole A, shown in Figure 6.40, and tilt the screwdriver forward. 3. Mount the forms and execute the SFTPRT in TEST mode, making sure that no error occurs.

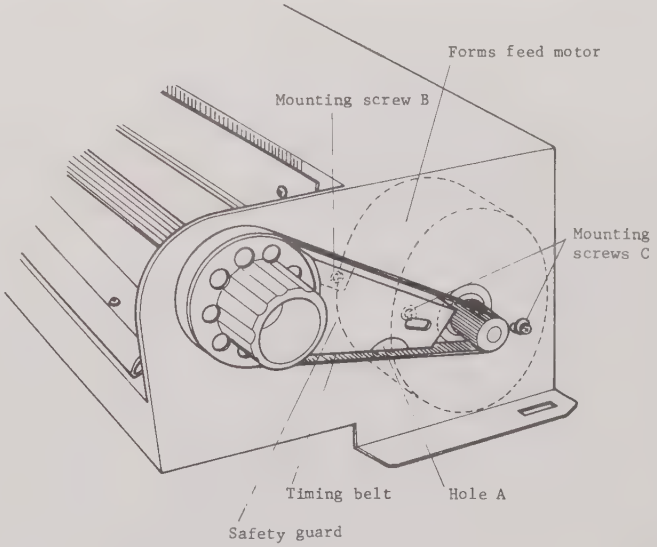


Figure 6.40 Replacing and adjusting the timing belt

REP NO.	Item	Repair
4030	Replacing and adjusting the forms feed motor (B020-1500-V314A)	Replacement 1. Follow the instructions given in REP 1100. 2. Open the top cover. 3. Remove the safety guard. (See REP 4020) 4. Open the forms rack. (See REP 1242.) 5. Pull out connector CNP31. 6. Shift the forms feed motor and loosen the tension on the timing belt by loosening the two mounting screws (C). In this step, do not remove the mounting screws (C). 7. Remove the mounting screws (C) to remove the forms feed motor. 8. Install the forms feed motor by reversing the removal procedure. Adjustment 1. Adjust the timing belt tension as described in REP 4020. 2. Mount the forms and execute the SFTPRT in TEST mode, making sure that no error occurs.

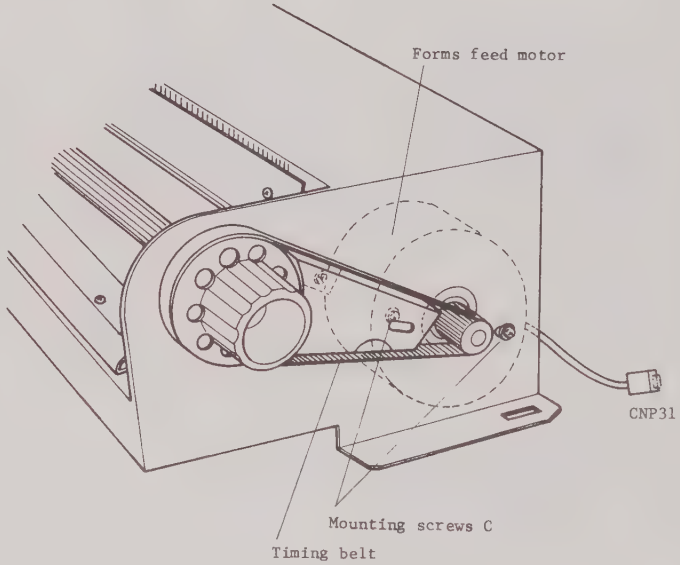


Figure 6.41 Replacing the forms feed motor

REP NO.	Item	Repair
4040	Replacing of the forms tractor (B020-1500-V310A/V311A) V310A: for right forms tractor V311A: for left forms tractor	Replacement 1. Follow the instructions given in REP 1100. 2. Open the top cover. 3. Remove the safety guard. (See REP 4020) 4. Open the forms rack (see REP 1242) and pull out connector CNP35 of the forms feed sensor. 5. Loosen the two mounting screws (B) to shift the forms feed motor. Loosen the tension on the timing belt and remove it. 6. Pull the forms guide out by holding its sections shown in Figure 6.42. 7. Remove mounting screw D through a hole in the ADVANCE FORMS knob with a screwdriver. It holds tractor shaft bearing A located on the right side of the frame unit. 8. Pull the shaft to the right, and pull the left edge of the shaft from the bearing B, and remove the O-ring. 9. Leaving the left and right forms tractors in the unit, pull the shaft further to the right. The shaft can then be pulled out completely from the right side with the bearing A attached. 10. Remove the forms tractors (left and right) from the guide plate by pinching the tractor release levers. 11. Install the forms tractors in the reverse of the removal procedure. 12. After reassembly, check that both the left and right forms tractors move smoothly in the same phase. Phase adjustment must be done as described in REP 4050. Adjust the timing belt as described in REP 4020. 13. Mount the forms and execute the SFTPRT in TEST mode, making sure that no error occurs.

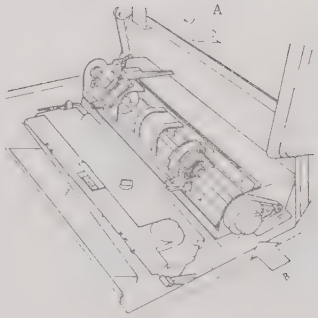


Figure 6.42 Replacing the forms tractor

REP NO.	Item	Repair
4050	Adjusting the forms tractor phase	Adjustment 1. Follow the instructions given in REP 1100. 2. Open the top cover. 3. Turn the pin wheel so that four mounting screws (E) can be seen from the side of the tractor cover frame. Loosen screws E and turn the pin wheel and align both the left and right tractor pins. 4. Inspect the tractor phase by checking whether printed lines align with the lines on the forms. 5. Mount the forms and execute the SFTPRT in TEST mode, making sure that no error occurs.

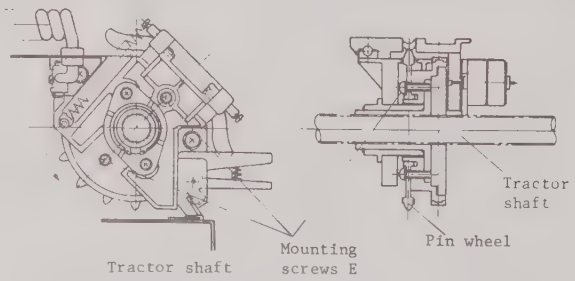


Figure 6.43 Adjusting the tractor phase

REP NO.	Item	Repair
4060	Replacing the pin wheel (B020-1500-X333A)	Replacement 1. Take the forms tractor out as described in REP 4040. 2. Remove the bushing retaining ring. 3. Remove the two mounting screws (F), and pull out the bushing. 4. Remove the pin wheel assembly in the X direction shown in Figure 6.44. 5. Remove the four mounting screws (E), pull out the pin wheel, and replace it with new one. 6. Install the pin wheel by reversing the removal procedure. 7. Assemble the pin wheel with mark L on its left surface when seen from the front (for both the left and right pin wheels). 8. Adjust the tractor shaft and wheel phase as described in REP 4050. 9. Mount the forms and execute the SFTPRT in TEST mode, making sure that no error occurs.

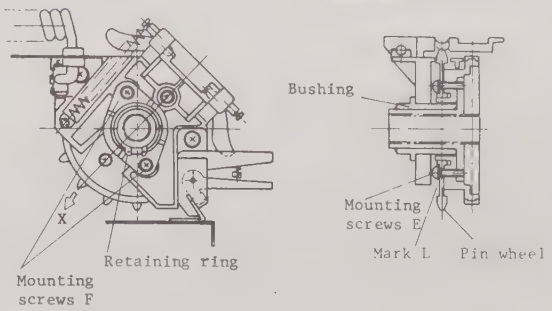


Figure 6.44 Replacing the pin wheel

REP NO.	Item	Repair
4070	Checking and adjusting the signal output from the forms feed sensor	Check While operating the forms feed unit with forms loaded (see the explanation for the FDTST in TEST mode in Section 3.3.3). Use an oscilloscope to observe waveforms between pins 5 and 6 of CN8 in the control circuit PC ' board (UHUMU) (See Figure 6.63 in REP 6050). Observe whether the waveforms are as shown in Figure 6.45. Adjustment 1. Tighten the two mounting screws (G) so that the forms feed sensor touches the forms guide of the tractor. 2. If the specified waveform cannot be obtained with the above adjustment, replace the forms feed sensor as described in REP 4080.

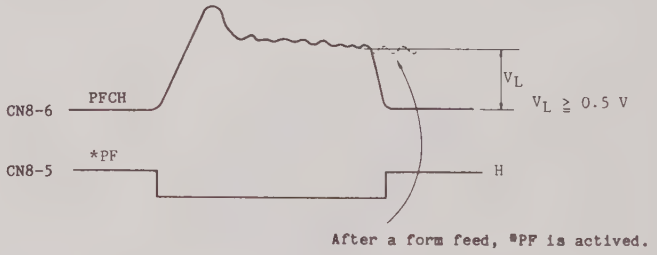


Figure 6.45 Output signal waveform the forms feed sensor

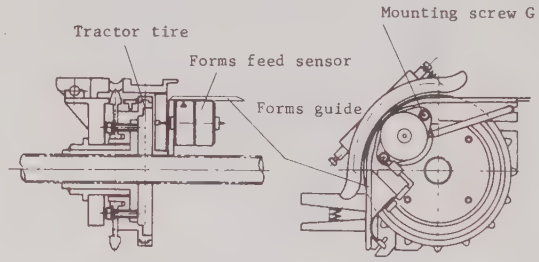


Figure 6.46 Adjusting the forms feed sensor

REP NO.	Item	Repair
4080	Replacing the forms feed sensor (B020-1500-V315A)	Replacement 1. Follow the instructions given in REP 1100. 2. Open the top cover. 3. Pull out connector CNJ36. 4. Remove the two mounting screws (G) and replace the forms feed sensor with a new one. 5. Install the forms feed sensor by pushing it upward. 6. Check and adjust the output signal of the forms feed sensor as described in REP 4070. 7. Mount the forms and execute the SFTPRT in TEST mode, making sure that no error occurs.

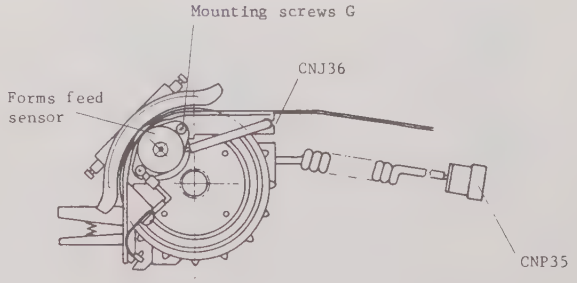
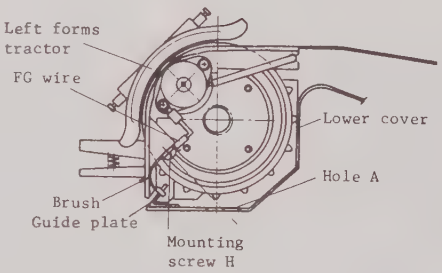


Figure 6.47 Replacing the forms feed sensor

REP NO.	Item	Repair
4090	Replacing the brush (B020-1500-X343A)	Replacement 1. Follow the instructions given in REP 1100. 2. Open the top cover. 3. Remove the forms feed unit (see REP 4010). Do not disconnect its cord. 4. Shift the position of the left forms tractor to loosen mounting screw (H), using a screwdriver through hole A in the lower cover of the forms feed unit. 5. Using a screwdriver, remove mounting screw H through hole A from the bottom rear of the printer, and take the brush out. 6. Install the brush by reversing the removal procedure. Because mounting screw H is also used as the FG terminal, it must be connected correctly. 7. Check that the brush touches the guide plate correctly. 8. Mount the forms and execute the SFTPRT in TEST mode, making sure that no error occurs.



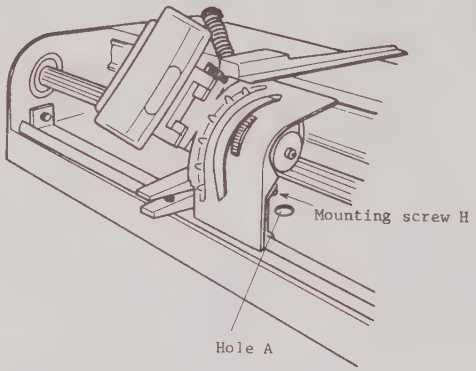


Figure 6.48 Replacing the brush

REP NO.	Item	Repair
4100	Replacing the discharger (B020-1500-V320A)	Replacement 1. Follow the instructions given in REP 1100. 2. Open the top cover. 3. Remove the three mounting screws (I) and remove the discharger. 4. Install the discharger by reversing the removal procedure. 5. Mount the forms and execute the SFTPRT in TEST mode, making sure that no error occurs.

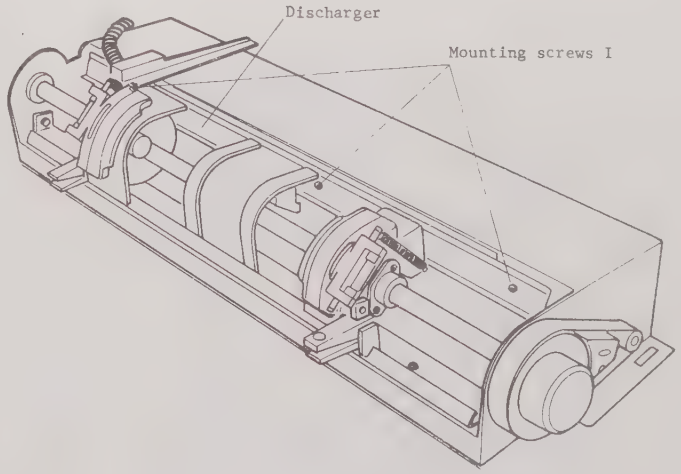


Figure 6.49 Replacing the discharger

REP NO.	Item	Repair
5010	Installing and removing the ribbon feed unit (B020-1500-V410A)	Removal 1. Follow the instructions given in REP 2000, but do not open the band cover. 2. Open the front door and remove the front panel. (See REP 6070.) 3. Pull out connectors CNP34 and CNP42 and remove the mounting screw (G) (See Figure 6.21 in REP 2070) to move the FG terminal. 4. Remove the ribbon. (See REP 5020.) 5. Remove mounting screws A and B, and remove the ribbon unit upward. 6. Remove mounting screw C and remove the ribbon feed unit. Installation 1. Install the ribbon feed unit by reversing the above procedure. 2. Correctly insert the guide pin of the ribbon feed unit bracket into the guide hole of the base unit. 3. Load the ribbon as described in REP 5020. 4. Make sure that the ribbon is normally fed and no error occurs during the RBNTST or SFTPRT in TEST mode.

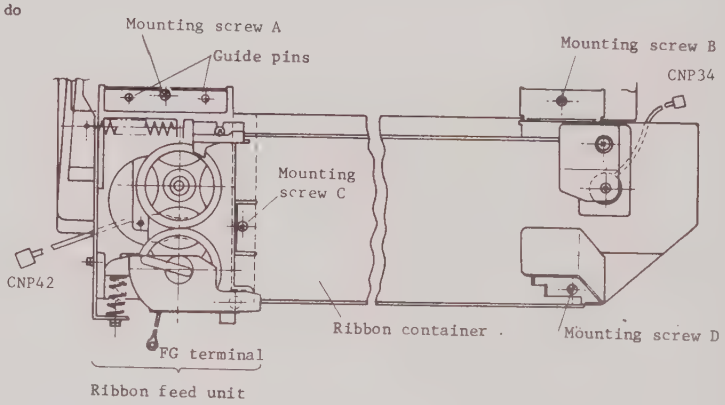


Figure 6.50 Installing and removing the ribbon feed unit

REP NO.	Item	Repair
5020-1	Replacing the ribbon (ribbon cartridge)	Unloading 1. Follow the instructions given in REP 2000, but do not open the print band cover. 2. Pull the ribbon drive release lever toward you, to disengage the ribbon feed rollers. 3. Remove the cartridge by picking up the handle on the left of the ribbon cartridge. At this time, any excess ribbon must be pushed into the cartridge.

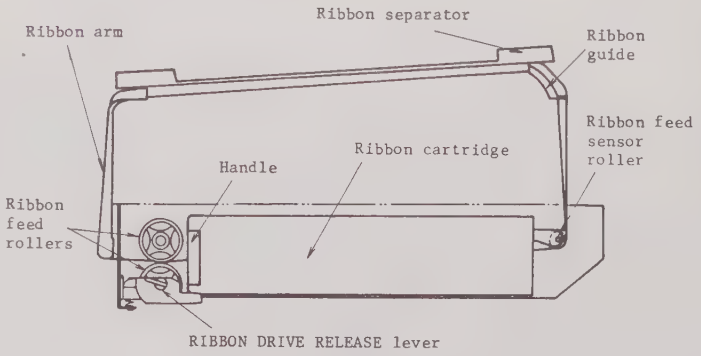
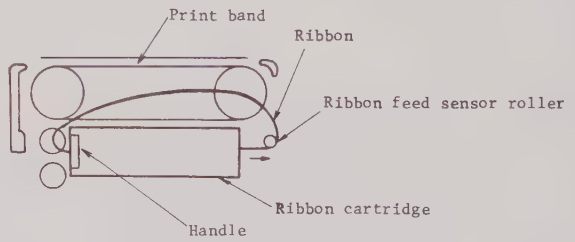
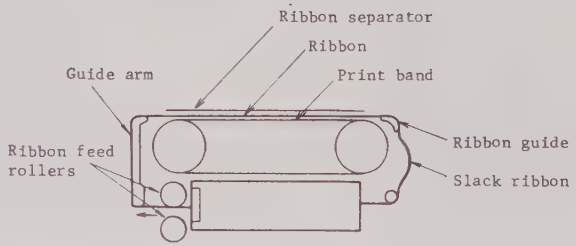


Figure 6.51 Ribbon path

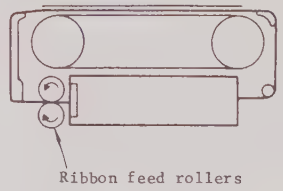
REP NO.	Item	Repair
5020-2	Replacing the ribbon (ribbon cartridge)	Loading 1. Pull the ribbon out from the exit port at the right of the ribbon cartridge, and lead the ribbon around the ribbon feed sensor roller. Push the cartridge down into the ribbon container. (See Figure 6.52-A.) 2. Pull the ribbon out from the entrance port at the left of the ribbon cartridge. Lead the ribbon between the ribbon feed rollers, then guide the ribbon onto the ribbon arm and lead it between the ribbon separator and the print band. Put it onto the ribbon guide on the right. (See Figure 6.52-B.) 3. Push the ribbon drive release lever back to its original position. 4. Take the slack out of the ribbon by rotating the ribbon feed rollers by hand. (See Figure 6.52-C.) Check that the ribbon is not twisted or loose. 5. Follow the instructions given in REP 2000 to return to the original status. 6. Make sure that the ribbon is normally fed and no error occurs during the RBNTST or SFTRPT in TEST mode.



(A)



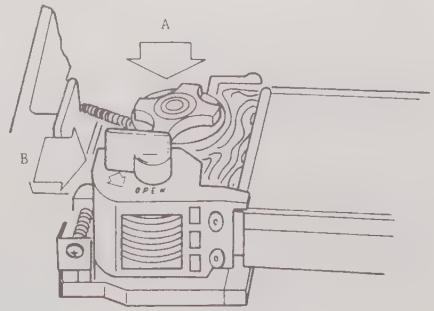
(B)

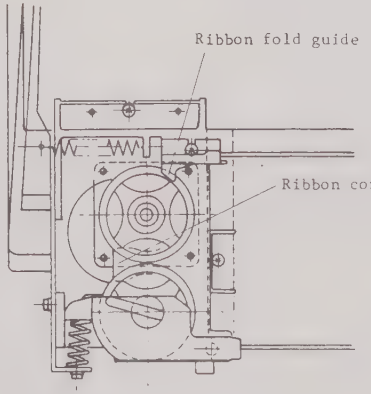


(C)

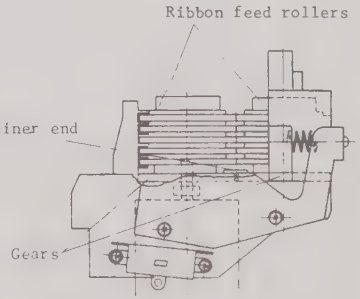
Figure 6.52 Loading the ribbon

REP NO.	Item	Repair
5030	Checking the ribbon feed roller	Check Check for the following: 1. Ribbon feeding must be normal. 2. All five ribbon feed roller steps must be tightly touching each other. In this position, the height of both gears must be equal. 3. The ribbon fold guide and the roller must not touch each other. Also the gear and ribbon container end must not touch. Adjustment 1. Adjust as described in REP 5040.





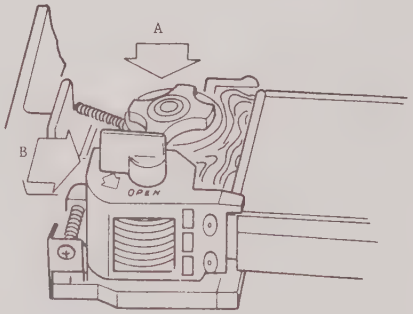
Top view of the ribbon feed roller
(seen in the A direction)

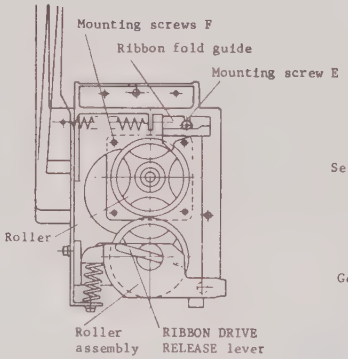


Side view of the ribbon feed roller
(seen in the B direction)

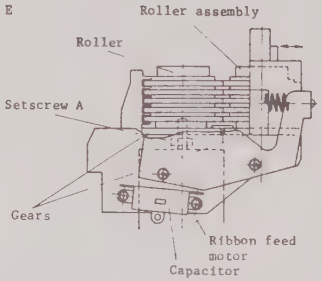
Figure 6.53 Ribbon feed roller

REP NO.	Item	Repair
5040	Replacing and adjusting the ribbon feed motor (B020-1500-V420A) and roller (B020-1500-V426A)	Replacement 1. Remove the ribbon feed unit as described in REP 5010. 2. Remove the connector of the ribbon feed motor capacitor. 3. Disengage the ribbon feed roller by pulling the ribbon release lever toward you. 4. Remove mounting screw E and remove the ribbon fold guide. Remove the two mounting screws (F) and remove the ribbon feed motor down through the hole in the frame. 5. Loosen setscrew A and separate the roller and the motor. 6. Reassemble by reversing the removal procedure. Adjustment 1. Secure the roller to the motor shaft where both the gears of the roller assembly and the roller (see Figure 6.54) are aligned and engaged. 2. Adjust the motor mounting position so that the outer ring of the roller coincides with the positioning projection of the ribbon fold guide. Check 1. Check as described in REP 5030. 2. Make sure that the ribbon is normally fed and no error occurs during the RBNTST or SFTPRT in TEST mode.





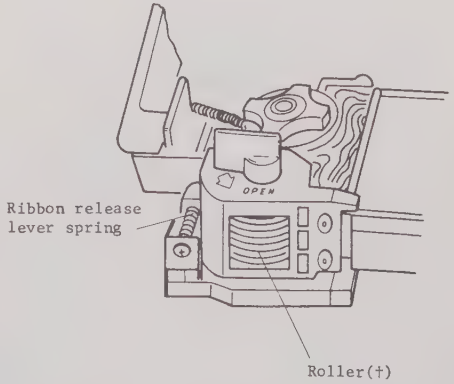
Top view of the ribbon feed unit (seen in the A direction)



Side view of the ribbon feed unit (seen in the B direction)

Figure 6.54 Replacing the ribbon feed motor and the roller

REP NO.	Item	Repair
5050	Replacing the roller assembly (B020-1500-V422A)	Replacement 1. Follow the instructions given in REP 1100. 2. Remove the ribbon release lever spring. 3. Pull the roller assembly upward and replace it with new one. 4. Reassemble by reversing the removal procedure. 5. Check the coupled state by opening and closing the ribbon release lever. 6. Make sure that the ribbon is normally fed and no error occurs during the RBNTST or SFTPRT in TEST mode.



† This is the same part as the roller in REP 5040.

Figure 6.55 Replacing the roller assembly

REP NO.	Item	Repair
5060	Replacing the ribbon arm (B020-1500-V412A), ribbon arm spring (B020-1500-X438A) and ribbon guide (B020-1500-X130A)	Replacement 1. **Follow the instructions given in REP 2000.** 2. Remove the ribbon only on the ribbon guide and the ribbon arm. 3. Remove the ribbon arm spring. 4. Remove the ribbon arm from the arm shaft. 5. Remove mounting screw G and remove the ribbon guide from the base unit. 6. Reassemble by reversing the removal procedure. 7. Make sure that the ribbon is normally fed and no error occurs during the RBNTST or SFTPRT in TEST mode.

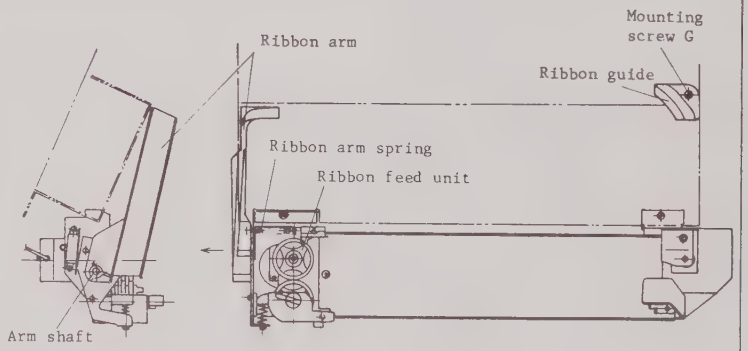


Figure 6.56 Replacing the ribbon arm, arm spring, and ribbon guide

REP NO.	Item	Repair
5070	Checking the signal output from the ribbon feed sensor (B020-1500-V424A)	Check 1. Observe the output signal shown in Figure 6.57 using an oscilloscope with its probe located at pin 7 of CN8 in the control circuit PC board (UTWMU) (see Figure 6.63 in REP 6050) while the ribbon runs (see the explanation of RBNTST in TEST mode in Section 3.3.3). 2. If the expected values are not obtained, clean the ribbon feed sensor roller as described in REP 1234. If the expected values are still not obtained, replace the ribbon feed sensor as described in REP 5080.

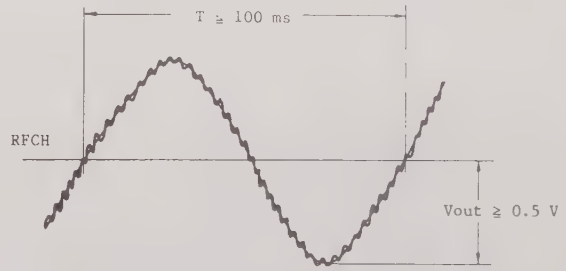
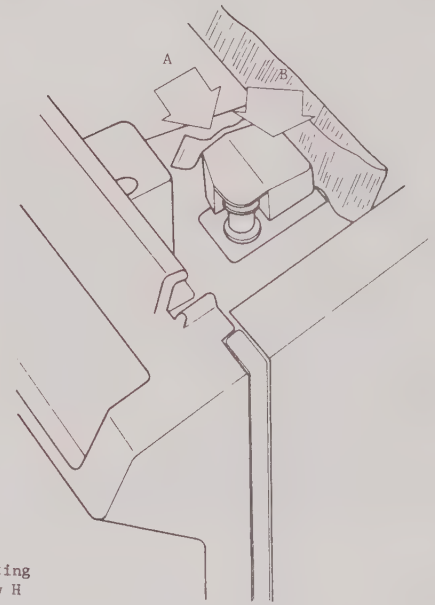
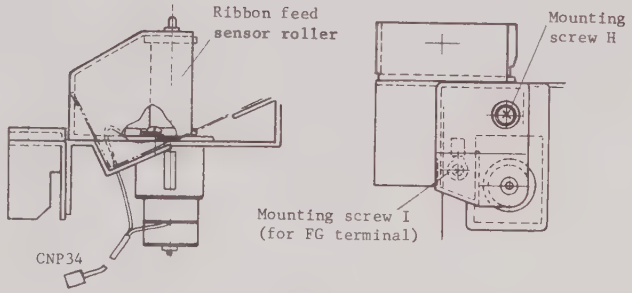


Figure 6.57 Ribbon feed sensor output signal

REP NO.	Item	Repair
5080	Replacing the ribbon feed sensor (B020-1500-V424A)	Replacement 1. Follow the instructions given in REP 2000. 2. Remove the ribbon from the ribbon feed sensor roller. 3. Remove the front panel. (See REP 6070.) 4. Remove connector CNP34. 5. Remove mounting screw H, lift up the ribbon feed sensor and tilt it. Remove the FG terminal by removing its mounting screw I, and remove the ribbon feed sensor to replace it with a new one. 6. Reassemble by reversing the removal procedure. 7. Check the output signal of the ribbon sensor as described in REP 5070. 8. Make sure that the ribbon is normally fed and no error occurs during the RBNTST or SFTPRT in TEST mode.





Side view of the ribbon feed sensor (seen in the A direction)

Top view of the ribbon feed sensor (seen in the B direction)

Figure 6.58 Replacing the ribbon feed sensor

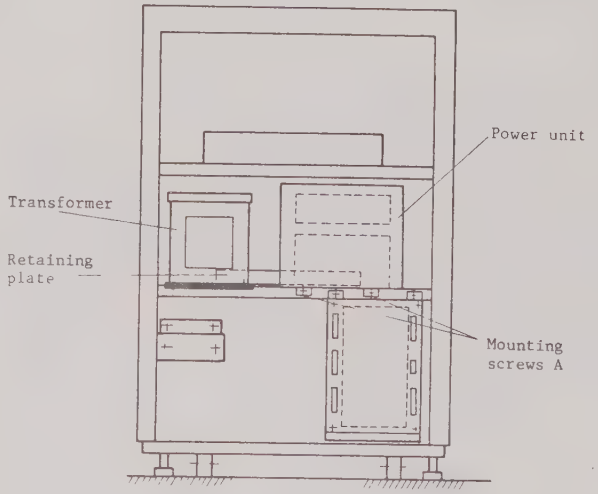
REP NO.	Item	Repair
6010	Checking and adjusting the output voltage	Check and adjustment Measure the voltages indicated in Table 6.3. When these voltages are not the reference voltages, adjust voltages with potentiometers RV1, RV2, and RV3. Check and adjust these voltages with the digital multimeter in the non-printing state. (See REPs 6030 and 6050.)

Table 6.3 Output voltage standard

No.	Item	Voltage	Check terminal	Potentiometer	Remarks
1	+5 V	5.0 V	W1 (+5 V) - W2 (0 V) (Figure 6.63)	RV2 (Figure 6.60)	
2	VD	28.0 V (23~ 29 V)	W1 (VD) - W3 (0 V) (Figure 6.60)	RV1 (Figure 6.60)	M3040 M3041
3	VD	29.0 V (25~ 30 V)	W1 (VD) - W3 (0 V) (Figure 6.60)	RV1 (Figure 6.60)	M3042
4	VD1	21.0 V	W4 (VD1) - W3 (0 V) (Figure 6.60)	RV3 (Figure 6.60)	

Note: The parenthesized voltages indicate the allowable voltage in the printing state.

REP NO.	Item	Repair
6020	Replacing the power unit (B14B-6105-D042A/D041A) D042A: for M3040 M3041 D041A: for M3042	Replacement 1. Follow the instructions given in REP 1100. 2. Open the forms rack. 3. Remove connectors CNP4, CNP5, CNP6, CNP7, CNJ8, and CNP11, and remove the leads connected to the transformer. (See Figure 6.61 in REP 6040) 4. Remove the two mounting screws (A) and pull out the power unit to replace it. 5. Install it in reverse of the removal procedure. In the installation, clamp the base plate with the retaining plate in the rear of the power unit.



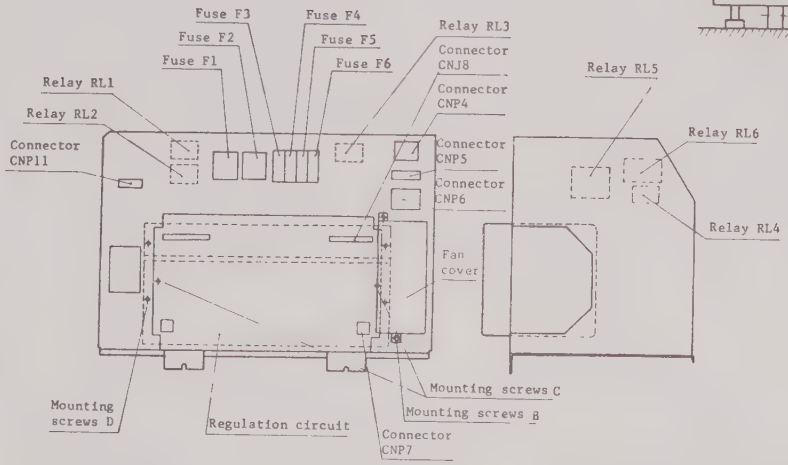


Figure 6.59 Power unit

REP NO.	Item	Repair
6030	Replacing the regulation circuit (B16B-8700-0030A#U and B16B-8700-0060A#U 0030A#U (VPBMU): for M3040 M3041 M3042 0060A#U (VPEMU): for M3042	Replacement (For M3040 and M3041) 1. Follow the instructions given in REP 1100. 2. Open the forms rack. 3. Remove power unit connectors CNJ10 and CNP9.(VPBMU) 4. Remove the two mounting screws (C) to replace the regulation circuit. (See Figure 6.59 in REP 6020.) 5. Install the regulation circuit in the reverse of the removal procedure. Replacement (For M3042) 1. Follow the instructions given in REP 1100. 2. Open the forms rack. 3. Remove the two mounting screws (B) to remove the fan cover. 4. Remove power unit connectors CNJ10 and CNP9. (VPBMU) 5. Remove the two mounting screws (C) to replace the regulation circuit (VPBMU). (See Figure 6.59 in REP 6020.) 6. Remove connectors CNJ25 and terminals CNP70 to CNP73. (VPEMU) 7. Remove two mounting screws (D) to replace the regulation circuit (VPEMU). (See Figure 6.59 in REP 6020.) 8. Install the regulation circuit in reverse of the removal procedure. Either CNP70 or CNP71 and either CNP72 or CNP73 can be inserted first.

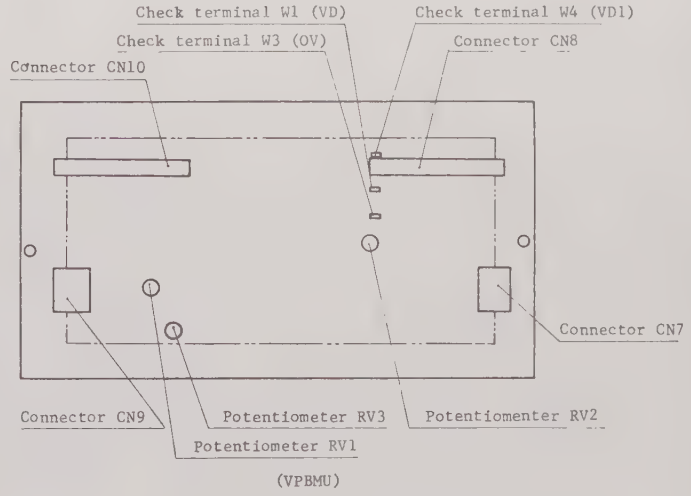


Figure 6.60 Regulation circuit

REP NO.	Item	Repair
6040	Replacing the transformer (B80L-0015-0067A/0066A) and setting the voltage 0067A: for M3040 M3041 0066A: for M3042	Replacement 1. Follow the instructions given in REP 1100. 2. Open the forms rack. 3. Remove the leads connected to the transformer. 4. Remove the two mounting screws (A) and pull the transformer toward you to replace it. 5. Install the transformer in the reverse of the removal procedure. 6. When installing the transformer, clamp the base plate with the retaining plate at the rear of the transformer. Setting the voltage Connect the lead without a tag to the transformer terminal corresponding to the required voltage according to Table 6.4.

Table 6.4 Voltage setting

Input voltage	Connected terminal
100 V	2
110 V	3
115 V	4
120 V	5
200 V	6
220 V	7
230 V	8
240 V	9

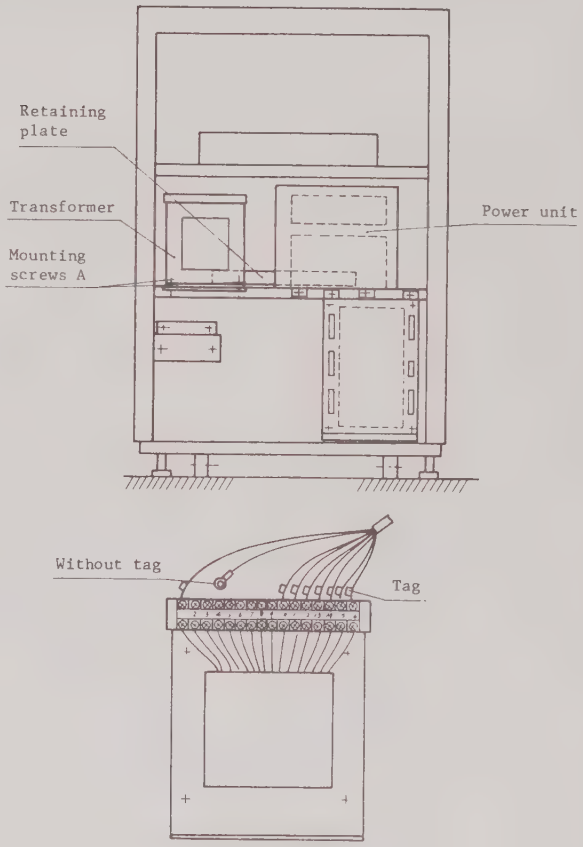


Figure 6.61 Transformer

REP NO.	Item	Repair
6050-1	Replacing the control circuit (B16B-8780-0100A#U)	Replacement 1. Follow the instructions given in REP 1100. 2. Open the forms rack. 3. Remove connectors CNP12, CNP13, CNP17, CNJ14, CNJ15, and CNJ16. 4. Remove the four mounting screws (A) to replace the control circuit. 5. Install the control circuit in the reverse of the removal procedure.

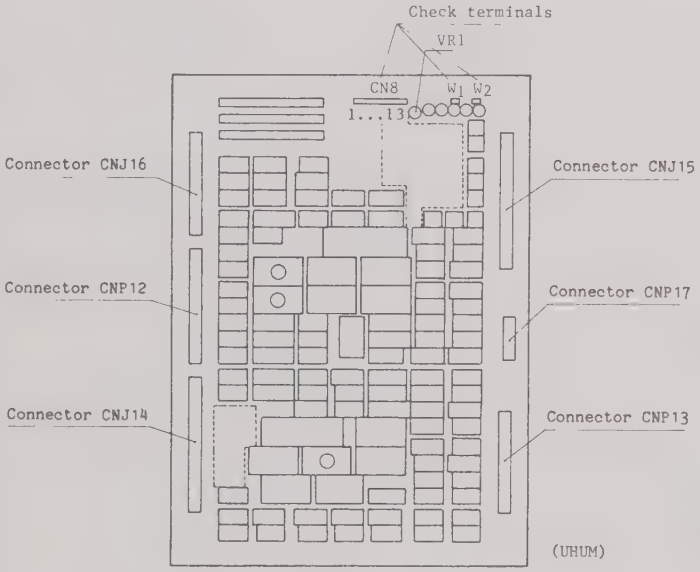


Figure 6.63 Mounting diagram of control circuit PC board

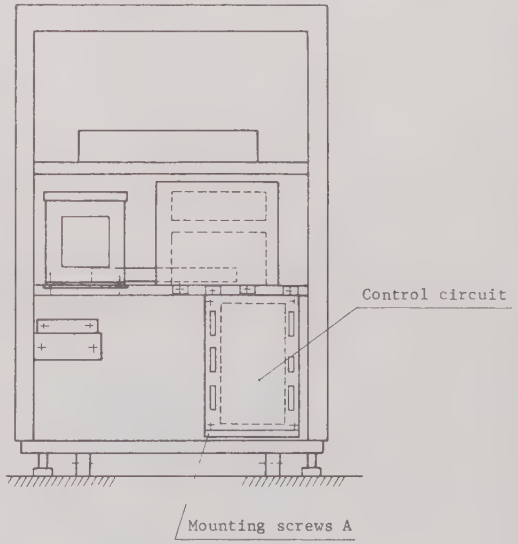


Figure 6.62 Replacing the control circuit

REP NO.	Item	Repair
6050-2	Replacing the control circuit (B16B-8780-0100A#U)	Table 6.5 Signal names of check terminals

Check terminal pin	Signal name
CN8-1	PSEP
-2	*PSEMA
-3	*PSWIND
-4	PSEM
-5	*PF
-6	PFCH
-7	RFCH
-8	DCHRG
-9	(not used)
-10	(not used)
-11	*BLTGO
-12	*RBNGO
-13	0 V
W_1	+5 V
W_2	0 V

REP NO.	Item	Repair
6060	Replacing the hammer magnet driver (B16B-8770-0010A#U)	Replacement 1. Follow the instructions given in REP 1100. 2. Open the forms rack. 3. Remove the eight connectors (CNA to CNH), which connect to hammer magnets, and power connectors CNP2 and CNP3, and control circuit connector CNJ1. 4. Loosen mounting screw A and lower the bracket for clamping the hammer magnet driver. 5. Pull the hammer magnet driver slightly downward toward you. 6. Install the hammer magnet driver in the reverse of the removal procedure. 7. Insert connectors according to their indications. 8. Adjust the timing between the *PWSIND and PSEM signals as described in REP 2051.

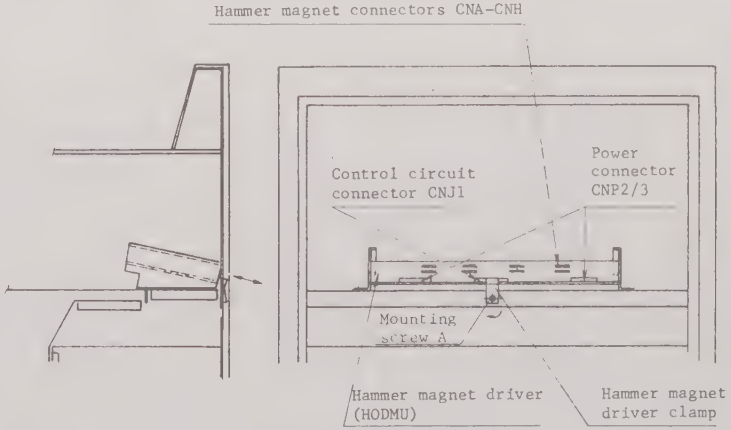


Figure 6.64 Replacing the hammer magnet driver

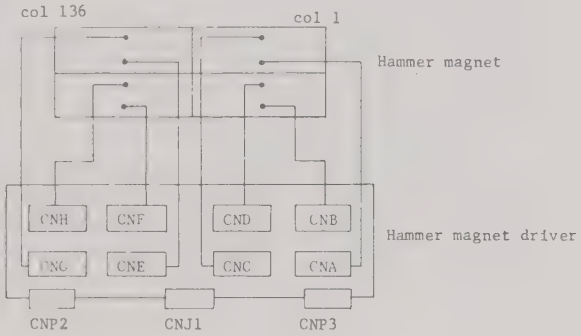


Figure 6.65 Hammer magnet wire connection

REP NO.	Item	Repair
6070	Replacing the operator panel (B16D-8770-0020A#U)	Replacement 1. Follow the instructions given in REP 1100. 2. Open the top cover. 3. Open the front door. 4. Remove connector CNP18. 5. Loosen mounting screw A (do not remove) from the bottom and lift the front panel by shifting its lower part. Remove the guide plate from the guide bracket groove, then remove the front panel. (See Figure 6.66.) 6. Remove the two mounting screws (B) to replace the operator panel. (See Figure 6.67.) 7. Reassemble in the reverse of the removal procedure.

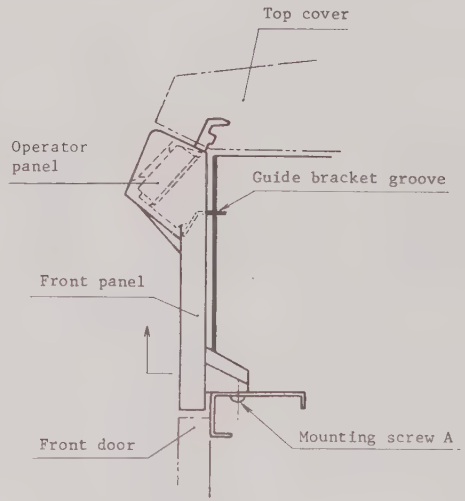


Figure 6.66 Removing the front panel

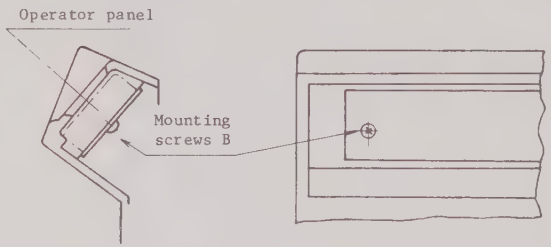


Figure 6.67 Replacing the operator panel

REP NO.	Item	Repair
6080	Replacing the fan unit (B020-1500-D021A)	Replacement 1. Follow the instructions given in REP 1100. 2. Open the forms rack. 3. Remove connectors CNP43 and CNP56. Release the cord in the cabinet side from the cord clamp. 4. Remove the two mounting screws (A) and replace the fan unit. The fan unit is very heavy, so handle it carefully. 5. Reassemble in the reverse of the removal procedure. Set the connector behind the fan unit.

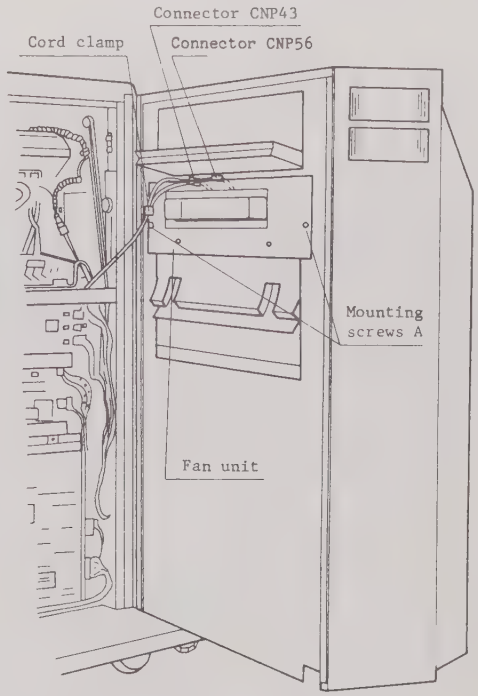


Figure 6.68 Replacing the fan unit.

REP NO.	Item	Repair
6090	Replacing the counterbalancer (B210-1840-X073A)	Replacement 1. Follow the instructions given in REP 1100. 2. Open the top cover. 3. Open the forms rack. 4. Remove the left and right counterbalancers from their hooks and the guide roller sections. 5. Install the counterbalancers in the reverse of the removal procedure. 6. Apply grease at the hooks.

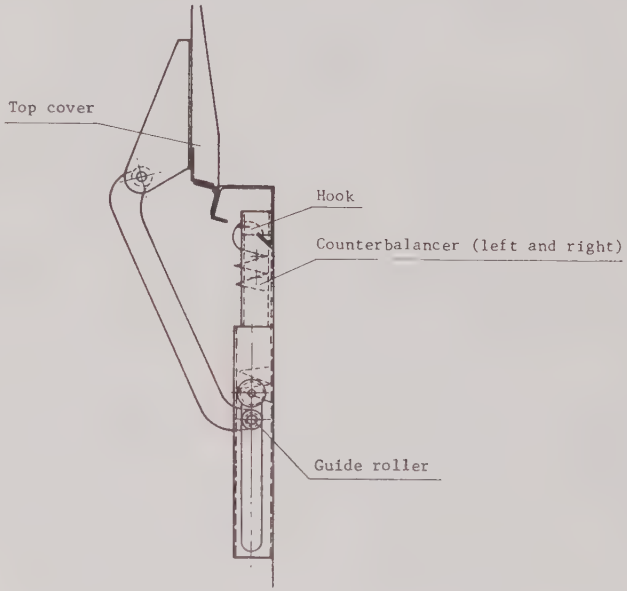


Figure 6.69 Counterbalancer

REP NO.	Item	Repair
6100	Replacing the chain (B30L-0170-004L#250)	Replacement 1. Follow the instructions given in REP 1100. 2. Open the front door. 3. Remove the two mounting screws (A) attaching the chain to the door, then replace the chain. 4. Install it in the reverse of the removal procedure.

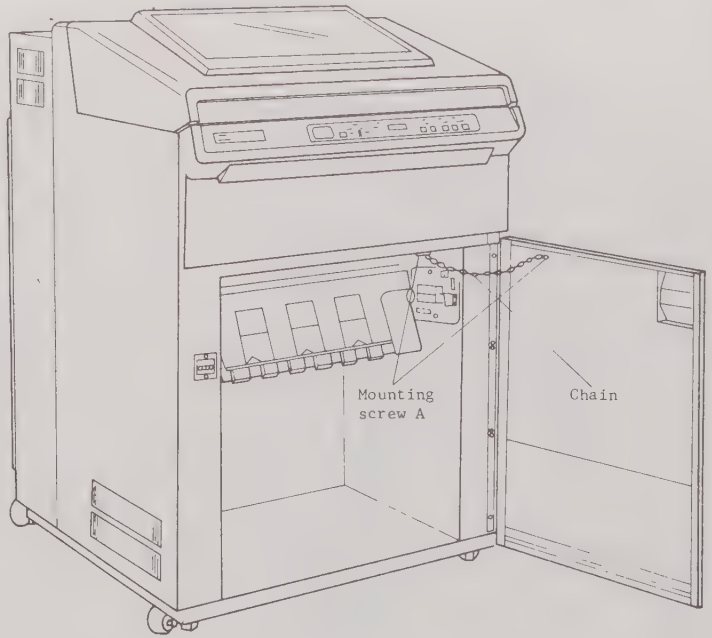
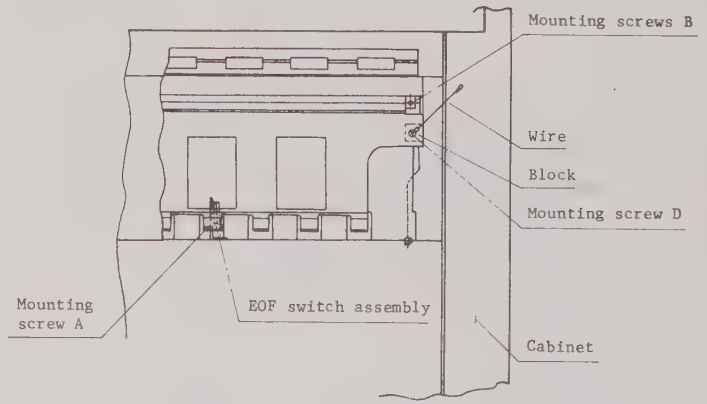


Figure 6.70 Front door chain

REP NO.	Item	Repair
6110	Replacing and adjusting the EOF switch assembly (B290-0590-V130A)	Replacement 1. Follow the instructions given in REP 1100. 2. Open the front door. 3. If the FCT unit is installed, remove it. (See REP 6130.) 4. Remove mounting screw D and take out the block. 5. Pull out the pin and remove the wire which links the EOF feeler and THROAT OPEN lever. 6. Lift the EOF feeler and remove mounting screws A (one screw) and B (two screws). 7. Pull the inserted terminals to the switch while pulling the EOF unit toward you. 8. Remove the two mounting screws (C) to replace the EOF switch assembly. 9. Install the assembly in the reverse of the removal procedure. Adjustment Mount the EOF switch assembly where the EOF feeler firmly presses the EOF switch assembly actuator against the stopper and operate the switch.



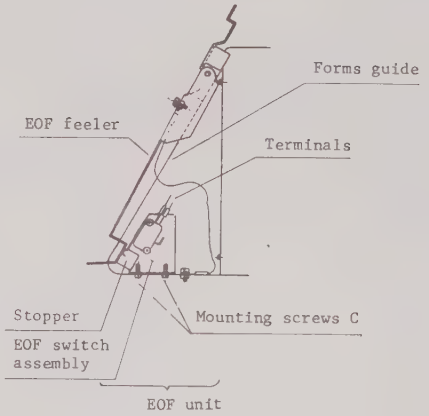


Figure 6.71 EOF switch assembly

REP NO.	Item	Repair
6120	Replacing the top cover interlock switch assembly (B290-0590-T101A)	Replacement 1. Follow the instructions given in REP 1100. 2. Open the top cover. 3. Open the forms rack. 4. Loosen the terminal screws of the switch and remove the two leads. 5. Remove the two mounting screws (A). Lower the top cover interlock switch assembly and take it through the plate guide-hole to remove it. 6. Install the assembly in the reverse of the removal procedure. 7. It must be fixed at the position shown in Figure 6.72 with the top cover opened. Note: When the switch actuator rod is pressed toward the switch while the top cover is open, the rod is moved slightly upward by the compression spring force and operates the switch, releasing the interlock. This state is the same as that when the top cover is closed. When the top cover is closed, the rod is restored to the original position.

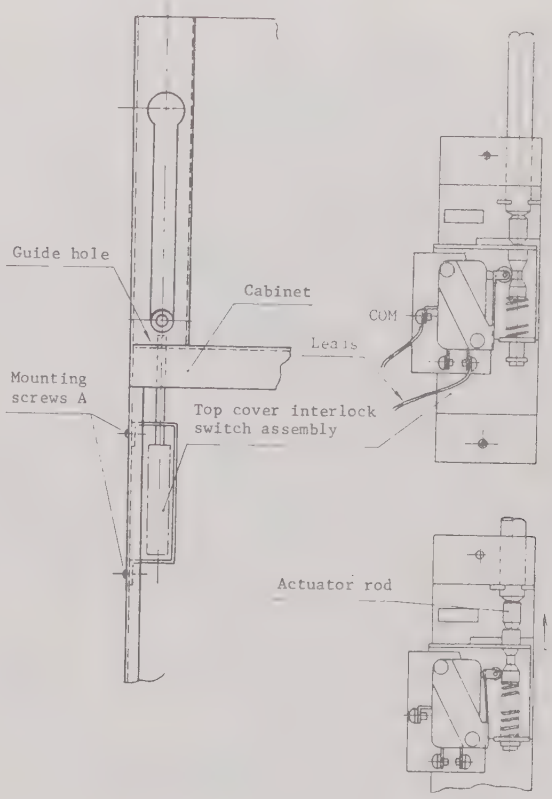


Figure 6.72 Top cover interlock switch assembly

REP NO.	Item	Repair
6130	Replacing the FCT unit (option)	Replacement 1. Follow the instructions given in REP 1100. 2. Open the front door. 3. Remove the two mounting screws (A). 4. Remove connectors CNP22 and CNP21 and replace the FCT unit. Never drop the cabinet-side connector into the cabinet side-frame. 5. Install it in the reverse of the removal procedure.

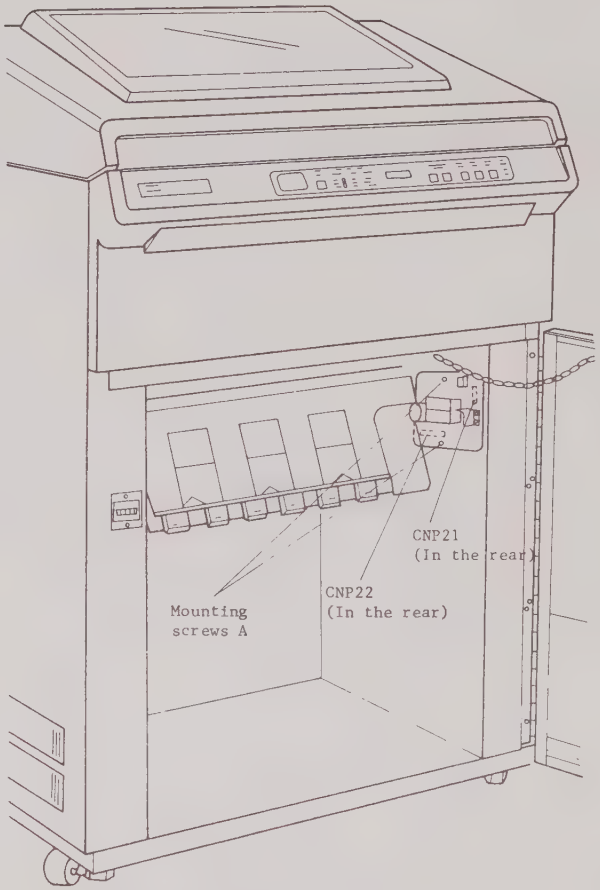


Figure 6.73 FCT unit

REP NO.	Item	Repair
6140	Replacing the line counter (option)	Replacement 1. Follow the instructions given in REP 1100. 2. Open the front door. 3. Remove the two mounting screws (A) and remove the line counter from the mounting hole. 4. Remove connector CNP32 and replace the line counter. Never drop the cabinet-side connector into the cabinet side-frame. 5. Install the line counter in the reverse of the removal procedure. 6. The counter value must be near (more than approximately 999990) but not exceeding zero (000000).

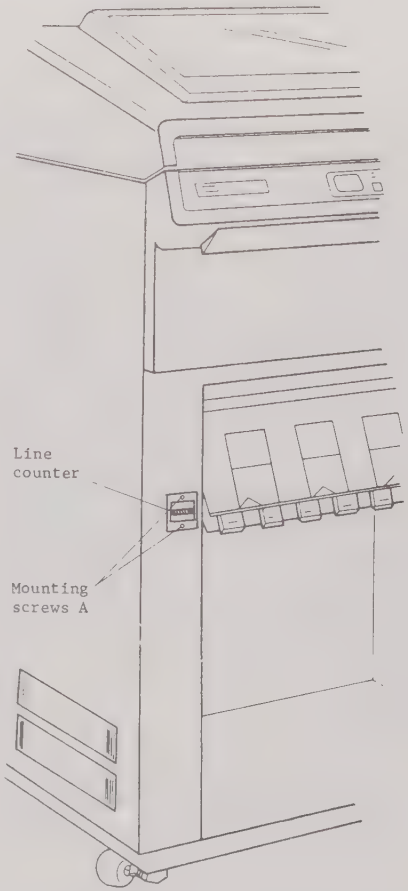


Figure 6.74 Mounting the line counter

APPENDIX A
EXPENDABLE SUPPLIES

This appendix provides specifications for printing paper (forms) and format control tapes (FCT) used for this printer and prepared by the user.

A.1 Forms Specification

Continuous fanfold forms, single copy or multiple copy, are used for this printer. The forms must have pin feed holes evenly lined up on both sides and horizontal perforations that run perpendicular to the forms feed direction. See Figure A.1

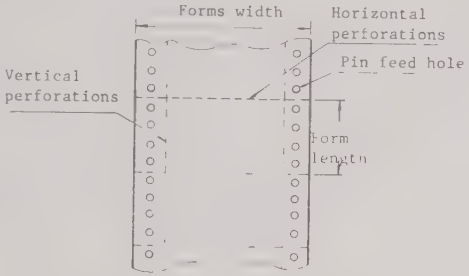


Figure A.1 Forms

When selecting forms for this printer, the user must conform to the following forms specifications:

A.1.1 General note about forms

This section describes paper quality and shape of the forms container.

(1) Paper quality

Paper used for forms should be of good quality, opaque, not too elastic, and suitable for printing. The paper must also be free from dirt, wrinkles, and tears. Torn paper can cause printing trouble.

Curled forms as shown in Figure A.2 will not be fed or stacked correctly after printing. Do not use curled forms.

Figure A.2 Curled forms

(2) Forms container

If the forms catch on container lids when being fed, feed errors may occur. Therefore arrange the lids as shown in Figure A.3.

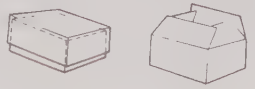


Figure A.3 Forms container lids

Inside space between the forms and container should be 4 to 7 mm (0.16" to 0.28"). The bottom of the box must be flat. See Figure A.4.

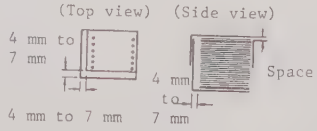


Figure A.4 Shape of the forms container

The forms container height must be 330.2 mm (13") or less to be installed in the forms hopper.

If the form length or folding dimension is more than 15", the front and rear doors must be open during operation.

A.1.2 Dimensions

This section describes dimensions of the forms, printing area, pin feed holes, and perforations.

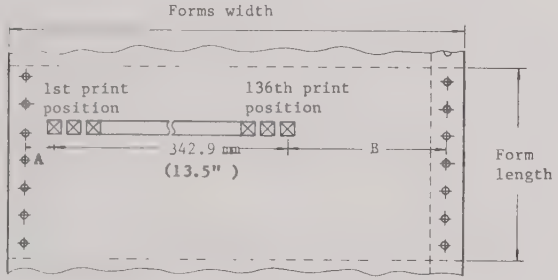
(1) Forms dimensions

Forms width: 76.2 to 431.8 mm (3" to 17")

Forms length: 76.2 to 381 mm (3" to 15")

(2) Positions and dimensions of the printing area

Figure A.5 illustrates the distances between the leftmost and rightmost print-position centers of the printing area and the pin feed hole center.

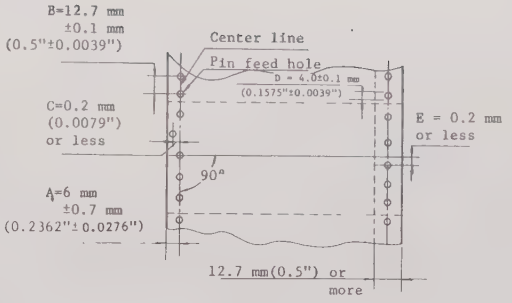


A-maximum: 63.5 mm (2.5") B-maximum: 68.6 mm (2.7")

Figure A.5 Leftmost and rightmost print positions

(3) Pin feed holes

Pin feed holes must be round. The dimensions relating to pin feed holes are given in Figure A.6.


B=12.7 mm ±0.1 mm (0.5"±0.0039")
Center line
Pin feed hole
D = 4.0±0.1 mm (0.1575"±0.0039")
C=0.2 mm (0.0079") or less
E = 0.2 mm or less
90°
A=6 mm ±0.7 mm (0.2362"±0.0276")
12.7 mm(0.5") or more

A: Distance between the forms edge and pin feed holes.
B: Distance between two consecutive pin feed holes.
C: Misalignment of the pin-feed hole center with other holes.
D: Diameter of a pin feed hole.
E: Misalignment of the pin feed hole with a hole on the opposite side.

Note: The total misalignment of any two holes on opposite sides of forms along a 254 mm (10") length must not exceed 0.3 mm (0.0118").

Figure A.6 Dimensions relating to pin feed holes

Poorly shaped pin feed holes and misalignment between left and right pin feed holes may result in inferior paper tensile strength. Misalignment must be within 0.2 mm (0.0079").

Pin feed holes that touch horizontal perforations may damage the paper. Pin feed holes must not overlap horizontal perforations.

Pin feed hole chad will probably cause problems with the printer. Chad may stick to the printing area, resulting in printing cutoff characters. Do not use such forms.

(4) Perforations

Perforations must be straight. The perforations should be of the size shown in Table A.1.

Table A.1 Perforation dimensions

Tie/Cut ratio and dimension / Kind / Designated mark / Number layers		Dimension of horizontal perforations			Dimension of vertical perforations		
		Strong	Medium	Weak	Strong	Medium	Weak
Tie/Cut ratio	1		about 1:2	about 1:1		about 1:3	about 1:2
	2, 3, 4, and 5	about 1:3	about 1:2			about 1:3	about 1:2
Tie dimension	1, 2, 3, 4, and 5	0.7 mm (0.0276") to 3.0 mm (0.1181")					
Cut dimension	1, 2, 3, 4, and 5	1.2 mm (0.0472") to 2.0 mm (0.0787")			1.2 mm (0.0472") to 3.0 mm (0.1181")		

Use weak or medium perforations shown in Table A.2. The dimensions of horizontal perforations should be 2 mm (0.0787") or less. If the dimensions of horizontal perforations exceed 2 mm, the portion sticking out (h in Figure A.7) at the cutting edge becomes larger and a feed error or forms damage may occur.

If separation at the perforations (fold) between each part is too great, the forms may be damaged or ink stains may result. The raised part at the fold (H in Figure A.7) must be 2 mm or less with the bottom layer kept flat by force.

Figure A.7 shows the protrusion and separation of the outer layer at the perforation of multiple-part forms.

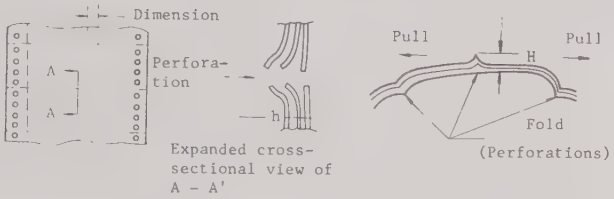


Figure A.7 Protrusion and separation of the outer layer at the perforation of multiple-part forms

A.1.3 Multiple-part forms

This printer utilizes up to 5-part forms. Interleaved carbon paper is not included in the number of parts. Forms with interleaved carbon paper, carbon-backed forms, and forms using carbonless copy paper are available as multiple-part forms. Each part of multiple-part forms must meet the specifications in Sections A.1.1 and A.1.2 in this appendix. They must be of the same length and width.

This section describes the fastening, misalignment, and thickness of multiple-part forms and also how multiple-part forms cause feed defects.

(1) Fastening multiple-parts

Each part of multiple-part forms must be fastened together at one or both pin feed hole areas by gluing or crimping. Multiple-part forms with interleaved carbon paper should be fastened on the right. Staples must not be used on forms. If they are used, the printer print section will be damaged and a feed error will occur.

For gluing, do the following:

- The shape of glued parts should be dots or stripes in the vertical direction, as shown in Figure A.8.
- Glue should be applied evenly and must not cause wrinkles or discolor the paper.
- Do not apply glue to the perforations. If stripe gluing is necessary, the glue must not ooze through perforations of the top and bottom layers.
- Glue cannot be used if forms lose pliability.

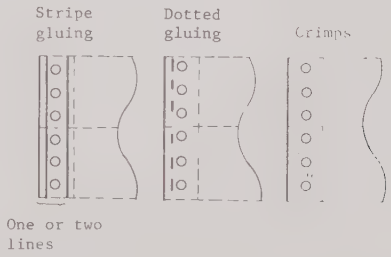


Figure A.8 Methods of fastening paper

For crimping, do the following:

- Layers must be firmly fastened and must not come loose.
- There should be no paper particles or dust.
- Forms should maintain their shape so as not to cause jams.
- Crimps must not overlap horizontal perforations. If crimps overlap horizontal perforations, the forms will tear at the perforation.
- Crimps should not project through the bottom sheet.

If layers of multiple-part forms are not properly fastened, the layers are likely to peel apart, causing feed defects.

(2) Misalignment of paper

Misalignment between layers should be within the range shown in Figure A.9.

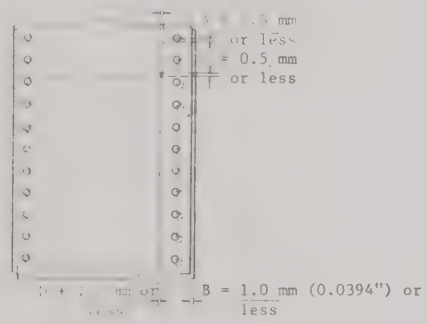

A = 0.5 mm (0.0197") or less
A: Misalignment of pin feed holes
B: Misalignment of edges
C: Misalignment of horizontal perforations
D: Misalignment of vertical perforations
B = 1.0 mm (0.0394") or less

Figure A.9 Allowable incorrect alignment of multiple-part forms

(3) Thickness of parts

Thickness of parts should be uniform. Thickness deviation in the print area must be within 0.076 mm (0.003"). Maximum total thickness of forms (including edges) is 0.6 mm (0.0236"). Table A.2 indicates recommended bond weight of each layer according to forms type.

Table A.2 Recommended bond weight of forms

Forms type	No. of parts	Bond weight (pound/bond)
Single-part forms	1	17
Forms with interleaved carbon paper	2	14
	3 and 5	12.5
Carbon-backed forms	2, 3, 4, and 5	11
Forms using carbonless copy paper	2 and 3	13
	4 and 5	11

When multiple-part forms are used, the forms can have different weights of parts (layers). However, the weight of each part should conform to the weights listed in Table A.2 according to the number of parts.

When forms are too thick, density fading between the top and bottom of each character will occur. When forms are too thin, they will be damaged and a feed defect will occur.

(4) Forms causing feed defects

The following forms are likely to cause feed defects, excluding those described before:

- Multiple-part forms with layers whose thickness or number varies by section, such as shown in Figure A.10.

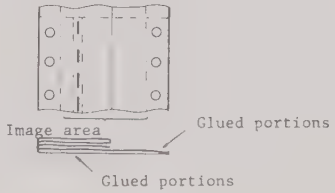


Figure A.10 Multi-part forms with layers of different thickness

- Multiple-part forms with layers glued in the print area (Printing should not be done on the glued portions.)
- Carbon paper which is covering pin feed holes of multiple-part forms (see Figure A.11)

A.2 Format Control Tape (FCT)

The 8- and 12-channel format control tapes (FCT) are used for loading vertical format control data into the forms control buffer (FCB) of the printer using the FCT unit. FCTs must conform to the following FCT specifications:

A.2.1 Medium quality

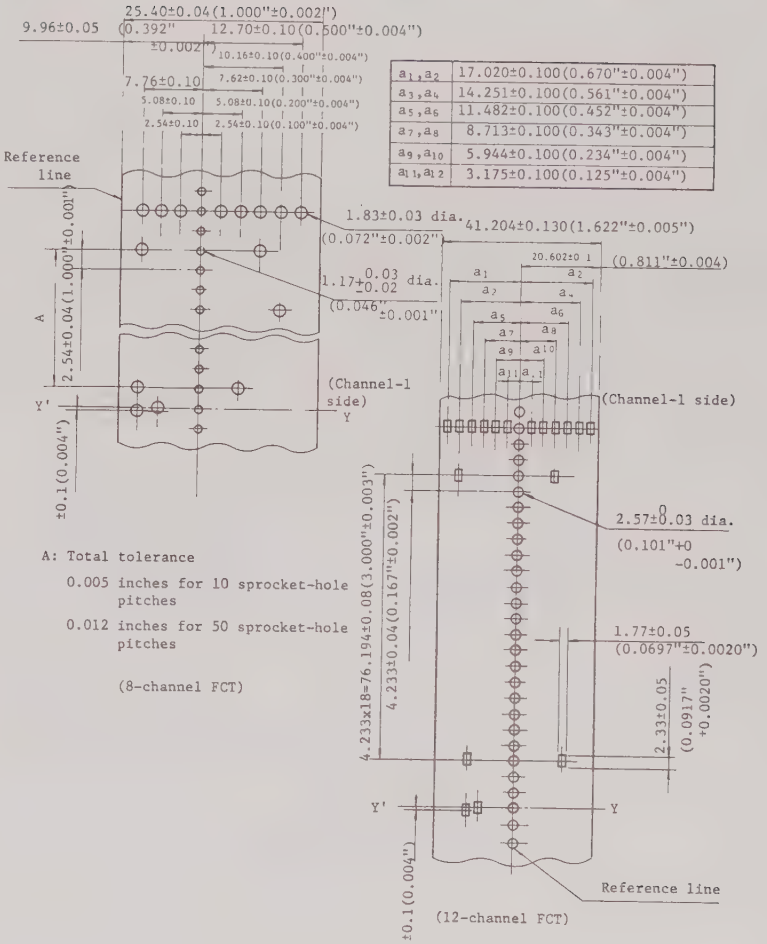
Medium used for the FCT should be:

Total thickness: 0.100 to 0.110 mm (0.0039" to 0.0043")
Light transmittance: 5% or less

An FCT made of a polyester resin film and paper would be stronger tensile, tearing, and folding.

A.2.2 Dimensions

The FCT dimensions vary with the 8- and 12-channel FCTs. The dimensions must be as shown in Figure A.13.



a_1, a_2	17.020±0.100(0.670"±0.004")
a_3, a_4	14.251±0.100(0.561"±0.004")
a_5, a_6	11.482±0.100(0.452"±0.004")
a_7, a_8	8.713±0.100(0.343"±0.004")
a_9, a_{10}	5.944±0.100(0.234"±0.004")
a_{11}, a_{12}	3.175±0.100(0.125"±0.004")

Notes: 1) The Y-Y' line is a sprocket-hole center line perpendiculor to the reference line.
2) When diameters of damaged sprocket holes become 0.005 inches wider than normal, replace the FCT.

Figure A.13 Specifications of FCT

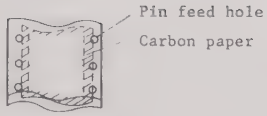


Figure A.11 Carbon paper covering pin feed holes

- Self-adhesive label forms in which all sides of the labels are cut (see Figure A.12)

  Such forms are likely to peel off. The side of every label in the forms feed direction must be perforated (not cut) to prevent peeling.

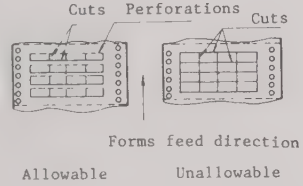


Figure A.12 Self-adhesive label forms

A.1.4 Ambient conditions for forms

The following are the ambient conditions in storage and usage:

(1) Storage

Temperature should be within 10°C to 30°C and, relative humidity within 30% to 70%.

(2) Usage

Temperature should be within 10°C to 30°C, and relative humidity within to 70%. If the conditions where it is stored and used are different, keep the paper for more than 48 hours in the environment where it will be used before using it.

A.1.5 Purchase order for forms

When ordering forms, specify the following items:

- Forms dimensions
- The number of parts
- Bond weight of each part
- Perforation position
- Perforation dimensions (tie and cut) for horizontal and vertical ones
- Carbon paper position (If carbon paper is used)
- Carbon-backed position (If carbon-backed paper is used)
- Fastening method for multiple-part forms
- Color of each part
- Type of carbon paper (If carbon paper is used)
- Carbon color (If carbon paper or carbon-backed paper is used)
- Copy color (If carbonless copy paper is used)
- Preprint on forms

For more detailed specifications, specify as required.
When specifying special forms, prepare a sample in advance and test it. Order after confirming that it will work.

APPENDIX B
DPC-COMPATIBLE INTERFACE

This appendix describes the DPC-compatible interface used for the I/O interface connected to the M304x series line printer (printer).

B.1 Operation Outline

Basic printer operations, data transfer, printing, and forms feed are shown in Figure B.1.

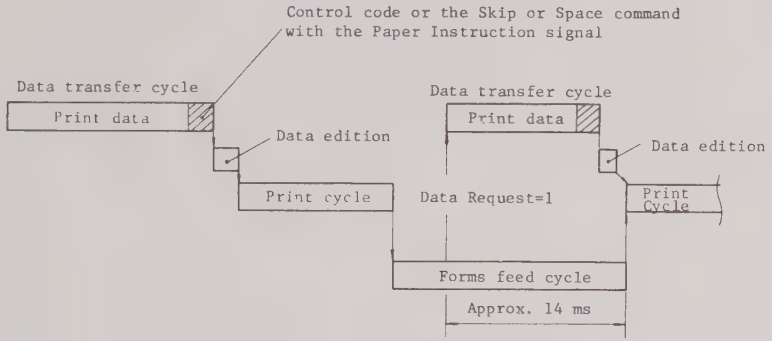


Figure B.1 Basic operations

The printer starts the print cycle after receiving 1-line print data sent from the mainframe and one of the following:

- Control code (LF, FF, or CR code)
- Skip command (with the Paper Instruction signal = 1)
- Space command (with the Paper Instruction signal = 1)

For the control codes and the Paper Instruction signal, see Sections B.3.2 and B.4.2. After 1-line printing, the printer starts the forms feed specified by the control code or with the Paper Instruction signal. The printer sets the Data Request signal to 14 ms before terminating forms feed and starts receiving the next line of data during forms feed. Therefore, unless the next line data is received within 14 ms, the print speed of the printer drops and it does not achieve the rated print speed.

If the control code or the Paper Instruction signal is received without print data, the printer does not print and only feeds forms. If the received print data is more than 132 or 136 bytes (only one of them is selectable at a time), then starting from byte 133 or 137, the rest of the data is ignored. If the received print data is less than 132 or 136 bytes, the remaining data is printed as spaces.

The print operation above is shown in Figure B.2.

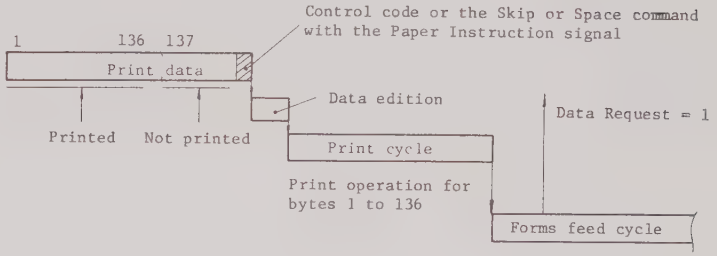


Figure B.2 Print operation

B.2 Interface Signals

This section explains the interface signal functions and physical specifications.

B.2.1 Interface signal lines

Table B.1 explains the DPC-compatible interface signal lines.

Table B.1 DPC-compatible interface signal lines (Positive logic)

Signal name	Signal level (†) 1	Signal level (†) 0	Direction System ↔ Printer	Contents
Write Machine Ready (WMR)	5 V	0	←	This signal is high (logical 1) when the following conditions are satisfied for the printer: • Power has come on and all voltage levels are normal. • The print unit is closed. • The end of forms is not detected. • Initialization process has been completed. • The hammer drive system is normal. • An error is not detected.
On line	5 V	0	←	This signal enables information to be transmitted with the system connected to the printer and goes high when the following conditions are satisfied: • Write Machine Ready (WMR) is 1. • The START/STOP switch is pressed. • The print band is rotating normally.
Data Request (DTRQ)	5 V	0	←	A synchronizing signal for data transferred from the system, and is high when data from the system can be accepted.
Write Strobe (WSB)	5 V	0	→	This is a strobe signal for Write Information to the printer. The printer resets its Data Request signal when the leading edge of this strobe signal is received.
Write Information 1-8(WIF1-8)	5 V	0	→	This is the input data from the system. (For ASCII 7-bit codes, WIF8 can be ignored by reconfiguration.)
Buffer Clear (BCLR)	5 V	0	→	The data for one line stored in the buffer of the printer is cleared by this signal.

Table B.1 - continued

Signal name	Signal level (†) 1	Signal level (†) 0	Direction System ↔ Printer	Contents
Connect 1 Connect 2	–	–	← →	This signal is used for confirming the connection of the interface connector. When the interface connector is connected, the Connect 1 and Connect 2 lines are connected.
Paper Instruction (PI)	5 V	0	→	This signal is high when forms control is performed by the system. When this signal is logical 1, the input data on the WIF lines is stored in the FCB. This signal is checked by the printer by the timing of the Write Strobe signal in the same way as WIF1 to WIF8. For details, see Section B.4.2 in this appendix.
Write Information Parity (WIFP)	5 V	0	→	Even parity signal for data from mainframe. Odd parity is also available by reconfiguration. This signal can be ignored by reconfiguration.
Write Check (††)	5 V	0	←	If a parity error occurs in WIF signals from the system, this signal is high.
Paper Moving (††)	5 V	0	←	This signal is logical 1 when the paper moves.
Bottom of Form (††)	5 V	0	←	When the last line on a page is being printed, this signal is high.
Top of Form (††)	5 V	0	←	When the first line on a page is being printed, this signal is high.
IDENT 0(††) IDENT 1	5 V	0	←	This signal indicates the type of print band. IDENT 1 / IDENT 0 0 / 0 Undefined 0 / 1 48-character-set print band 1 / 0 64-character-set print band 1 / 1 96-character-set print band

† Signal level 1 Active
Signal level 0 False
Negative logic is also available by reconfiguration (except for Connect 1/2 signals).

†† These signals can always be set to 0 by reconfiguration.

Figure B.3 shows the timing chart of this interface.

This printer has a print data buffer (PDB) for 136 characters. While a WMR signal and Online signal are being generated, print data is received according to the timing chart shown in Figure B.3. Printing starts when the following control character code or Paper Instruction signal is received.

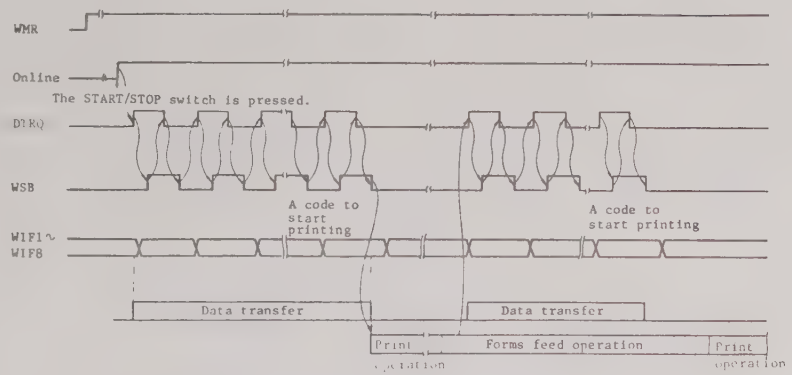


Figure B.3 Basic data transfer operation

The signal timing specifications in data transfer are shown in Figure B.4.

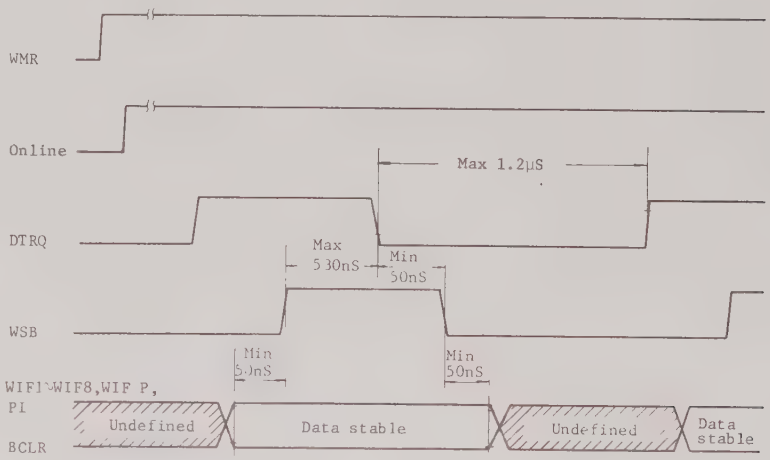


Figure B.4 Timing of signals in data transfer

B.2.2 Physical specifications of interface signals

The physical specifications of DPC-compatible interface signals consist of electrical characteristics, interface cable specifications, and connector pin arrangement specifications.

(1) Electrical characteristics

Signal levels must be within the following ranges:

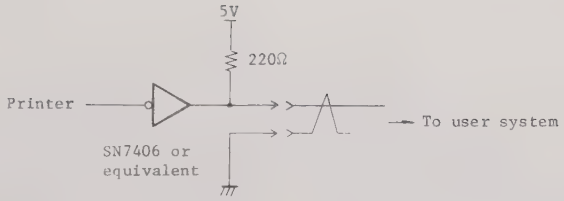
Low level 0.0 to + 0.4 V

High level + 2.4 to + 5.0 V

Note: The signal levels above are at the interface connector.
Incorrect signals may be sent in power-on power-off.

The interface signal driver and receiver must be the same as those shown in Figure B.5.

• Driver



• Receiver

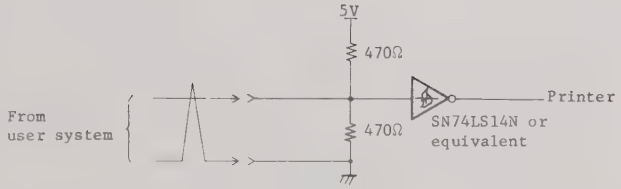


Figure B.5 DPC-compatible interface signal driver and receiver

(2) Interface cable

Twisted pair cables must be used for the interface cable. The cable length must be 15 m or less.

(3) Connectors and pin arrangement

Either an AMP-type or Winchester-type connector is available for the interface connector of the printer. Figures B.6 and B.7 show AMP-type and Winchester type connector pin arrangements.

No.	Signal name	No.	Signal name	No.	Signal name
1	WIF 3	18	(WIF5) RTN	34	WIF 5
2	(WIF 3) RTN	19	WIF 1	35	(WIF 7) RTN
3	(WIF 1) RTN	20	WIF 2	36	WIF 7
4	(WIF 2) RTN	21	Online	37	(Write Strobe) RTN
5	(Online) RTN	22	WMR	38	Write Strobe
6	(WMR) RTN	23	Data Request	39	-
7	(Data Request) RTN	24	Top of Form	40	(WIF 4) RTN
8	(Top of Form) RTN	25	Bottom of Form	41	WIF 4
9	(Bottom of Form) RTN	26	Paper Moving	42	(WIF 6) RTN
		27	Write Check	43	WIF 6
10	(Paper Moving) RTN	28	WIF 8	44	(WIF 8) RTN
11	(Write Check) RTN	29	WIF P	45	Connect 1
12	+5 V (max. 200 mA)	30	Paper Instruction	46	Connect 2
13	(WIF P) RTN	31	Buffer Clear	47	-
14	(Paper Instruction) RTN	32	(IDENT 0) RTN	48	-
15	(Buffer Clear) RTN	33	-	49	IDENT 1
16	(IDENT 1) RTN			50	IDENT 0
17	-				

Connector specifications
Amp 205740-1 or equivalent (Printer side)
Amp 205212-1, 66506-9, or equivalent (Cable side)

Figure B.6 DPC-compatible interface connector pin arrangement (Amp type)

		Buffer Clear	A			WIF 1	B
(Data Request) RTN	C	Data Request	E	(WIF 1) RTN	D	WIF 2	F
(Buffer Clear) RTN	H	———	K	(WIF 2) RTN	J	WIF 3	L
Bottom of Form	M	(Bottom of Form) RTN	P	(WIF 3) RTN	N	WIF 4	R
Top of Form	S	(Top of Form) RTN	U	(WIF 4) RTN	T	WIF 5	V
Paper Moving	W	(Paper Moving) RTN	Y	(WIF 5) RTN	X	WIF 6	Z
IDENT 1	a	(IDENT 1) RTN	c	(WIF 6) RTN	b	IDENT 0	d
———	e	———	h	(IDENT 0) RTN	f	Write Strobe	j
(WIF 7) RTN	k	WIF 7	n	(Write Strobe) RTN	m	Paper Instruction	p
Write Check	r	(Write Check) RTN	t	(Paper Instruction) RTN	s	WIF 8	u
Connect 1	v	Connect 2	x	(WIF 8) RTN	w	Online	y
WIF P	z	(WIF P) RTN	BB	(Online) RTN	AA	WMR	CC
———	DD	———	FF	(WMR) RTN	EE	+5 V (max.200mA)	HH

Connector specifications
MRA50S-D5J made by Winchester (Printer side)
MRAC50P-JTDH8 made by Winchester (Cable side)

Figure B.7 DPC-compatible interface connector pin arrangement (Winchester type)

B.3 Character and Control Codes

Table B.2 shows character codes. In the table, areas enclosed with a bold faced line indicate control codes, whereas the other areas indicate character codes (ASCII codes). The table shows character codes of 8-bit mode. In 7-bit mode, character codes X'00' to X'7F' are available. Character codes with an asterisk in the table vary with the print band for each country, as shown in the lower table.

Table B.2 Character codes (ASCII)

▭: Control code area

B_8					0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
B_7					0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
B_6					0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
B_5					0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
B_4	B_3	B_2	B_1	L U	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	0	0	0			SP	0	@*	P	'*	p								
0	0	0	1	1			!	1	A	Q	a	q								
0	0	1	0	2			"	2	B	R	b	r								
0	0	1	1	3			#*	3	C	S	c	s								
0	1	0	0	4			$*	4	D	T	d	t								
0	1	0	1	5			%	5	E	U	e	u								
0	1	1	0	6			&	6	F	V	f	v								
0	1	1	1	7			'	7	G	W	g	w								
1	0	0	0	8			(	8	H	X	h	x								
1	0	0	1	9			)	9	I	Y	i	y								
1	0	1	0	A	LF		*	:	J	Z	j	z								
1	0	1	1	B			+	;	K	[*	k	{*								
1	1	0	0	C	FF		,	<	L	*	l	|*								
1	1	0	1	D	CR		-	=	M	]*	m	}*								
1	1	1	0	E			.	>	N	^*	n	~*								
1	1	1	1	F			/	?	O	_	o									

Note: Codes with an asterisk in the table above vary with the print band for each country as follows:

Code / Country	X'23'	X'24'	X'40'	X'5B'	X'5C'	X'5D'	X'5E'	X'60'	X'7B'	X'7C'	X'7D'	X'7E'
U.S.A.	#	$	@	[	\	]	^	`	{	|	}	~
U.K.	£	$	@	{	\	}	^	`	{	|	}	~
France	£	$	à	°	ç	§	^	`	é	ù	è	¨
Germany	#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
Sweden	#	¤	É	Ä	Ö	Å	ú	é	ä	ö	å	ü
Denmark	#	$	É	Æ	ø	Å	ú	é	æ	ø	å	ü

B.3.1 Character codes

The ASCII codes are standard for character codes.

If the printer receives a character code not specified in the character code table or not included on the print band, the character code is changed to the space code (X'20') and no character is printed for the code. If a character code from X'A0' to X'FE' is received in 7-bit mode, the WIF8 signal can be ignored (regarded as 0) by reconfiguration, and a character corresponding to each code from X'20' to X'7E' is printed. For the setting method, see Section 3.3.4.

When receiving character codes, the printer sequentially loads them in its internal buffer (IBF). Characters corresponding to the loaded character codes are printed after a control code is received. The IBF is cleared after printing. The character code received next is for column 1.

B.3.2 Control codes

The line feed (LF), form feed (FF), and carriage return (CR) codes are control codes indicated in the area enclosed with a boldfaced line in Table B.2. The printer starts an operation, such as printing, forms feed, loading data, and modifying a set mode when the control code is received.

(1) LF code (X'0A')

When receiving the LF code, the printer starts printing characters corresponding to the received character codes from column 1. After printing the characters, the printer spaces. If the number of character codes received before the LF code is less than 132 or 136, the remaining characters are treated as spaces. If the LF code is received without character codes, the printer does not print, it only feeds forms.

(2) FF code (X'0C')

When receiving the FF code, the printer starts printing characters corresponding to the received character codes from column 1. After printing the characters, the printer feeds forms to the top-of-form (TOF) line, or if FCB data is loaded, to the line with channel 1. For definitions of the TOF and channel 1, see Section B.4.1. If the number of character codes received before the FF code is less than 132 or 136, the remaining characters are treated as spaces. If the FF code is received without character codes, the printer does not print, it only feeds forms.

Even if the forms are positioned at the TOF or channel-1 line, the printer feeds forms to the next TOF or channel-1 line. If there is no channel 1 in the loaded FCB data, the printer feeds forms to the first line on the next page.

(3) CR code (X'0D')

When receiving the CR code, the printer starts printing characters corresponding to the received character codes from column 1. One of the following modes are available for the operation after printing:

- Mode without forms feed

  The printer does not feed forms after printing. When receiving the CR code without character codes, the printer does nothing.
- Automatic spacing mode (LF code mode)

  The printer spaces after printing. When receiving the CR code without character codes, the printer only spaces. The CR code is treated as the LF code in this mode.

Select one of the above modes by setting the desired mode at the operator panel. For the setting method, see Section 3.3.4.

(4) Undefined control codes

Control codes undefined in the control code area in Table B.2 are treated as space codes.

B.4 Format Control

To control forms feed, in addition to control codes, the printer uses format control functions that specify the form (page) length and the page print format. These functions are as follows:

- Forms control buffer (FCB)
- Format control tape (FCT) unit option
- Form length function

The FCB and the form length function are standard features of this printer. The FCT unit can be incorporated as an option.

When the FCB is used, format control data is loaded from the mainframe (system) into the printer in online mode. When the FCT is used, format control data is loaded from the FCT unit into the printer in offline mode.

The format control data is indicated with channels that are used by software to specify special positions of the form.

B.4.1 Definition of the top of form (TOF) and the bottom of form (BOF)

The TOF and BOF are used for forms feed control.

(1) TOF

The TOF is defined as follows:

a. When the FCB data has been loaded, the TOF is the line to which channel 1 is first specified in the FCB data.

b. When the FCB data has not been loaded or when channel 1 is not contained in the FCB data, the TOF is the first line on the page.

(2) BOF

The BOF is defined as follows:

a. When the FCB data has been loaded, the BOF is the line to which the BOF channel is first specified in the FCB or FCT. (The BOF channel can be specified with any channel number at the operator panel. For the channel specification method, see Section 3.3.4.)

b. When the FCB data has not been loaded or when the BOF channel is not contained in the FCB, the BOF is the last line on the form (page) without the skip-over perforation specification. That is, if the number of lines skipped to the perforation is specified using the skip-over perforation feature, the BOF is the last line not skipped. For the setting method of the skip-over perforation feature, see Section 3.3.4.

B.4.2 Specification of a forms feed format

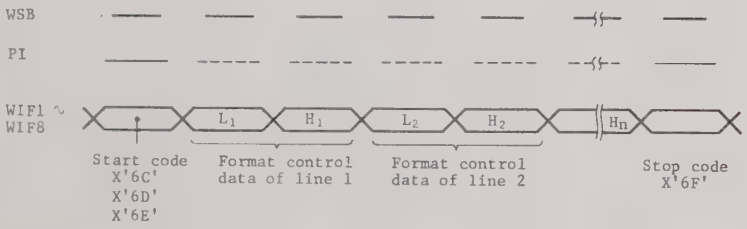
The forms feed information must be loaded into the FCB before forms feed, except when a control code, LF code, or CR code, is specified.

The FCB data is loaded from the mainframe via the I/O interface or from the optional FCT unit. The loaded FCB data is used for forms feed control by the FF code or by the Skip command transferred after print data.

Form (page) length and line spacing (6/8 LPI) are set at the operator panel. For the setting method, see Section 3.3.4.

(1) Format specification by FCB

The format control data is loaded from the mainframe into the FCB of the printer in online mode. Figure B.8 shows the timing of FCB data loading.



Notes: 1) The PI signal level indicated by dashed lines can be either high or low.
2) The Ln and Hn indicate a low-order byte and a high-order byte.

Figure B.8 Timing of FCB data loading

If the data code expressed by WIF1 to WIF8 is X'6C', X'6D', or X'6E' when the Paper Instruction signal is 1, the printer treats the data code as the start code for FCB data loading and loads into the FCB the data following the start code, until the printer receives the stop code X'6F'. The stop code is also sent with the Paper Instruction signal.

The transferred data is first loaded into the print data buffer (PDB) in the IBF. Then the interface control (IFC) microprogram loads the data into the FCB and determines the number of lines per page by counting the loaded FCB data bytes.

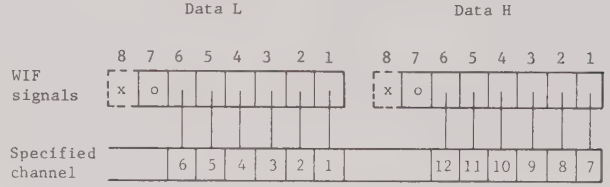
Table B.3 shows the definition of the start code.

Table B.3 Definition of the start code

WIF 8 7 6 5 4 3 2 1	Code (Hex)	Operation	
0 1 1 0 1 1 0 0	6C	Line spacing is 6 lpi.	Six or eight lpi specification from the operator panel is ignored.
0 1 1 0 1 1 0 1	6D	Line spacing is 8 lpi.	
0 1 1 0 1 1 1 0	6E	Forms are fed in 6/8 lpi when specified at the operator panel.	

Note: WIF8 is ignored and treated as 0 in 7-bit mode.

In Figure B.8, $L_1H_1L_2H_2 \ldots L_nH_n$ ($2 \leqq n \leqq 255$) is the format control FCB data. Each L or H is one byte of data. Each pair of an L and H is format control data for one line on the form. L_1H_1 is data for line 1, L_2H_2 is data for line 2, and so forth. L_nH_n is data for the last line, and n indicates the total number of lines on a form (page). The first byte (L) of the 2-byte line format data specifies a channel number from 1 to 6 and the second byte (H) specifies a channel number from 7 to 12. Figure B.9 shows the correspondence between channels and WIF1 to WIF8.



Note: X do not care. (In 8-bit mode)

Figure B.9 Correspondence between FCB data channels and bits

Even if FCB data other than X'6F' (stop code) is received with WIF7 = 1, WIF7 is ignored (treated as 0) and WIF6 to WIF1 are treated as format control data and stored in the FCB. However, WIF7 should be 0, except when stop code X'6F' is used.

The total number of bytes contained in the FCB data $L_1H_1L_2H_2...$ L_nH_n must be even. If it is odd and the stop code X'6F' follows, an error occurs. At that time, the printer feeds forms determining that the H_n byte not received (data of channel 7 to 12) for the last line is X'00' and that the total number of lines on a form (page) is n lines.

If n is 1, an error occurs because there must be two or more lines on a page.

If n is greater than 255 -- that is, more than 255 lines are specified for a page -- an error occurs and data from the 256th line and after is lost because the FCB holds only 255 lines. The printer feeds forms for a maximum of a 255-line page, storing up to byte 255, which corresponds to line 255, in the FCB. The stop code is required because the printer continues FCB data loading until it receives this code.

FCB data must be loaded after character codes are received, printed, and cleared because character codes are destroyed and data is loaded into the FCB incorrectly if the printer receives character codes before the FCB load start code.

Line 1 must be set to the print line of the printer before or immediately after FCB data loading because the FCB address counter is reset to 1 after FCB data is received (that is, the printer treats line 1 as the print line after FCB data is loaded).

If the printer receives start codes other than X'6C', X'6D', and X'6E', it feeds forms as though it had received a Skip or Space command.

Example of FCB data:

- Line spacing: 6 lines/inch
- Form length: 66 lines

Figure B.10 shows the channels specified for a forms feed format.

Table B.4 lists the FCB data. It is assumed that the BOF is set to channel 12 in the printer.

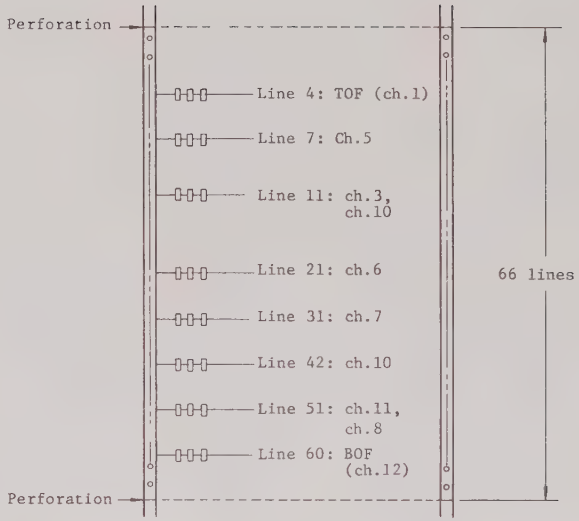


Figure B.10 Channels specified for a forms feed format

Table B.4 FCB data example

Data sequence	Data (hex)	Line	Channel 12	11	10	9	8	7	6	5	4	3	2	1	Data meaning
1	6C														6 LPI, start code
2-7	00	1-3													
8	01	4												o	TOF (Channel 1)
9	00														
10-13	00	5-6													
14	10	7								o					Channel 5
15	00														
16-21	00	8-10													
22	04	11			o						o				Channels 10 and 4
23	08														
24-41	00	12-20													
42	20	21							o						Channel 6
43	00														
44-61	00	22-30													
62	00	31						o							Channel 7
63	01														
64-83	00	32-41													
84	00	42			o										Channel 10
85	08														
86-101	00	43-50													
102	00	51		o			o								Channels 11 and 8
103	12														
104-119	00	52-59													
120	00	60	o												BOF (Channel 12)
121	20														
122-133	00	61-66													
134	6F	-													End code

(2) Format specification by format control tape (FCT)

The FCT is a looped paper tape with punched holes and sprocket holes for feeding. The punched hole data is read by the FCT unit and sent to the printer to notify it of a forms feed format. Figure B.11 is an example of the FCT and shows the relationship between a forms feed format and punched holes.

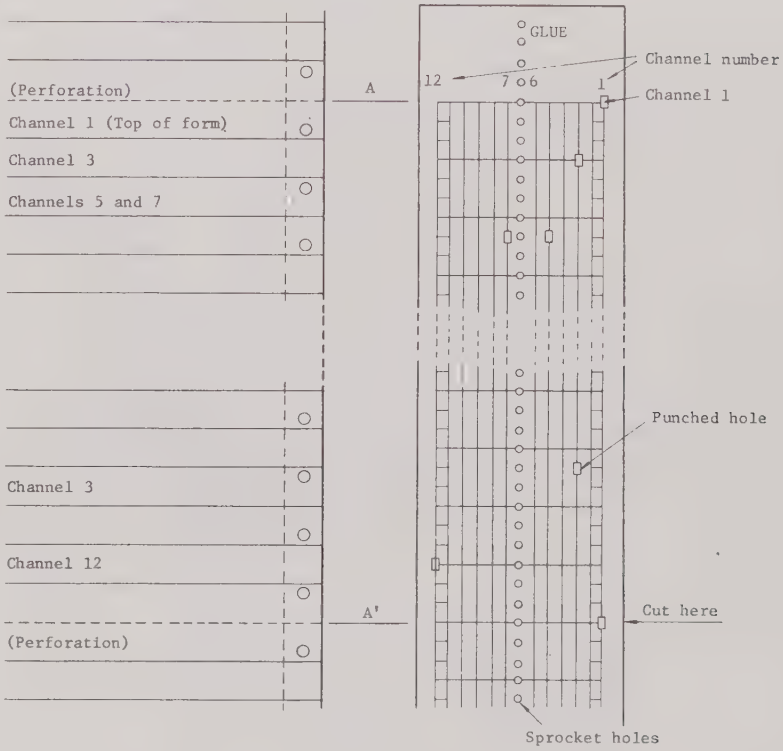


Figure B.11 An example of FCT and forms feed format

There are 2 types of FCT: 8-channel and 12-channel. Figure B.11 shows a 12-channel FCT, where each FCT sprocket hole corresponds to each line of the form. Punched holes, called channels, indicate special positions of the forms, and are used for forms feed control by software. When a new forms feed format is used, the old FCT must be replaced with one for the new forms feed format.

The FCT is read automatically when the printer is turned on or when the RUN switch on the FCT unit is pressed in offline mode. The RUN switch enables a new FCT to be read. Because the FCT unit determines that channel 1 of the FCT is the start position, the FCT reads punched hole data starting from channel 1 to the next channel 1 detected.

The data from the FCT unit is sent to the interface control (IFC) microprocessor. Then, the IFC microprogram loads the data into the FCB in the internal buffer.

Make an FCT as follows:

1. Punch a hole at the first column on the center line of the first sprocket hole (channel 1 as the top of form), as shown in Figure B.11.
2. For subsequent lines, punch holes according to the forms feed format. Note that columns 1 to 12 (1 to 8 for an 8-channel FCT) correspond to channels 1 to 12 (1 to 8 for an 8-channel FCT). For example, punch a hole at the third column on the center line of the fourth sprocket hole when channel 3 is specified for the fourth line in the forms feed format. For two more examples, punch holes at the fifth and seventh columns on the center line of the eighth sprocket hole when channels 5 and 7 are specified for the eighth line in the forms feed format. Figure B.11 shows these examples.
3. Punch a hole at the first column (channel 1) on the sprocket-hole center line corresponding to the last line of the print form and cut the FCT there.
4. Align the center lines of the first sprocket hole (A in Figure B.11) and the last sprocket hole (A' in Figure B.11) of the FCT, glue these ends together, and confirm that no punched holes are covered.

Notes: 1) Because channel 1 is defined as the BOF, there must be one hole, which indicates channel 1, per print form.
2) The FCT should not exceed 255 lines.
3) An FCT must be longer than 10 inches so that the FCT can be installed in the FCT unit. When the form length is less than 66 lines for a 12-channel FCT (100 lines for an 8-channel FCT), the same hole pattern must be repeated once on the FCT to extend the FCT length.
4) The FCT used for this printer must conform to the specifications shown in Appendix A.

(3) Format specification from the operator panel

The number of lines per page is used to specify the page length at the operator panel. Thus, a page length specified with 6 LPI differs from that specified with 8 LPI even if the form is the same length.

The number of lines skipped to avoid printing on or too near a perforation is also specified at the operator panel.

Figure B.12 is an example of format specification from the operator panel.

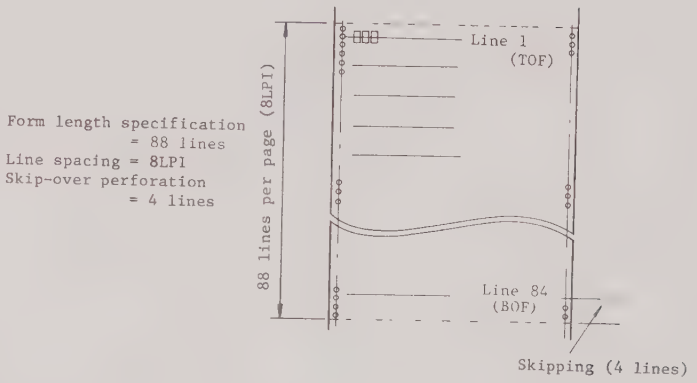


Figure B.12 An example of format specification from the operator panel

For the setting method, see Section 3.3.4.

B.4.3 Skip and Space commands

The Skip or Space command sent via the I/O interface controls forms feed. The Skip or Space command is sent with the Paper Instruction signal after print data is sent.

(1) Skip commands

Skip commands feed forms up to the line corresponding to the channel specified in the format control data (in the FCB) after printing. If data WIF1 to WIF8 sent with the Paper Instruction signal is the same as that shown in Table B.5, the printer (IFC microprogram) determines that the data indicates a Skip command. The relationship between Skip command data and specified channel numbers is shown in Table B.5.

Table B.5 Skip commands

WIF data 8 7 6 5 4 3 2 1	Hex.	Specified channel
X X X 0 0 0 0 0	00	Channel 1
0 0 0 0 1	01	Channel 2
0 0 0 1 0	02	Channel 3
0 0 0 1 1	03	Channel 4
0 0 1 0 0	04	Channel 5
0 0 1 0 1	05	Channel 6
0 0 1 1 0	06	Channel 7
0 0 1 1 1	07	Channel 8
0 1 0 0 0	08	Channel 9
0 1 0 0 1	09	Channel 10
0 1 0 1 0	0A	Channel 11
0 1 0 1 1	0B	Channel 12
0 1 1 0 0	0C	Error (no specified channel)
0 1 1 0 1	0D	
0 1 1 1 0	0E	
0 1 1 1 1	0F	

X: Do not care.

After the printer receives a Skip command and prints all characters in the PDB, the printer feeds forms up to the line with the specified channel number. If the Skip command is received before the 132nd or 136th character code, the remaining characters are treated as spaces. If the Skip command is received without character codes, the printer does not print, it only feeds forms.

If there are several channels with the same channel number in the FCB, after printing, the printer feeds forms up to the nearest line with the specified channel number. Therefore, if the forms are positioned at the line with the specified channel, the printer feeds forms up to the next line that has the same channel number specified.

Even though signals WIF6 to WIF8 are ignored, if the WIF data is X'6C', X'6D', or X'6E' (the start code for FCB loading), the data is treated as an instruction to start FCB loading. Thus, WIF6 to WIF8 must be 0, however, WIF8 is ignored in 7-bit mode. WIF5 must be 0 because WIF5 indicates Space commands.

If no channels are specified in the FCB, the printer detects an error and only prints, it does not feed forms. Because commands X'0C' to X'0F' specify invalid channels, the printer detects them as errors.

(2) Space commands

Space commands feed forms the specified number of lines after printing. If data WIF1 to WIF8 sent with the Paper Instruction signal is the same as that shown in Tables B.6 and B.7, the printer (IFC microprogram) determines that the data indicates a Space command. The relationship between Space command data and the number of lines fed is shown in Tables B.6 (15-line feed mode) and B.7 (63-line feed mode).

Table B.6 Space commands (15-line feed mode)

WIF data 8 7 6 5 4 3 2 1	Hex.	No. of lines fed
X X X 1 0 0 0 0	10	0
1 0 0 0 1	11	1
1 0 0 1 0	12	2
1 0 0 1 1	13	3
⋮	⋮	
1 1 1 1 0	1E	14
1 1 1 1 1	1F	15

Table B.7 Space commands (63-line feed mode)

WIF data 8 7 6 5 4 3 2 1	Hex.	No. of lines fed
X 0 0 1 0 0 0 0	10	0
0 0 1 0 0 0 1	11	1
0 0 1 0 0 1 0	12	2
⋮	⋮	⋮
0 0 1 1 1 1 1	1F	15
0 1 1 0 0 0 0	30	16
0 1 1 0 0 0 1	31	17
⋮	⋮	⋮
0 1 1 1 1 1 1	3F	31
1 0 1 0 0 0 0	50	32
1 0 1 0 0 0 1	51	33
⋮	⋮	⋮
1 1 1 1 1 1 0	7E	62
1 1 1 1 1 1 1	7F	63

Space commands are used in the following modes:

- 15-line feed mode

  A maximum of 15 lines can be fed. WIF6 to WIF8 are ignored.

- 63-line feed mode

  A maximum of 63 lines can be fed. WIF7, WIF6, and WIF4 to WIF1 indicate the number of lines fed. WIF8 is ignored.

One of these modes can be selected at the operator panel. For the selection method, see Section 3.3.4.

When the printer receives a Space command, the printer feeds forms the specified number of lines after printing all characters in the PDB. If the Space command is received before the 132nd or 136th character code, the remaining characters are treated as spaces. If the Space command is received without character codes, the printer does not print, it only feeds forms.

WIF5 must be 1 because WIF5 indicates Space commands.

If a Space command attempts to feed forms past the TOF position, the forms feed can be stopped at the TOF position. This feature is called the step-count truncate. This feature can also be set at the operator panel. For the setting method, see Section 3.3.4.

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